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Ashore, afloat and Airborne : The Logistics of British Naval Airpower, 1914-1945

Jones, Benjamin

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Department of War Studies
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Ashore, afloat and airborne:
The Logistics of British Naval Airpower, 1914-1945

Benjamin Jones

Thesis submitted for the Degree of Doctor of Philosophy
2007

Candidate's Declaration

I hereby declare that all the work presented in this thesis is my own.

A handwritten signature in black ink, appearing to read "Ben Jones". The signature is written in a cursive, slightly stylized font.

Benjamin Jones

6th November 2007

Abstract

This thesis analyses the logistics behind the expansion and operations of the Royal Naval Air Service and the Fleet Air Arm during the two World Wars. The logistics of British naval aviation has largely been a peripheral topic compared with operational issues. Studies of aviation during both World Wars are also unusual. The aim is to study this topic largely through the available original material, both official and unofficial, and thereby to provide a new focus for the analysis of naval aviation.

Both organisations had to expand from a small base under the exigencies of wartime conditions, in 1914 when aviation was in its infancy and in 1939 just after the Navy had regained full control over naval aviation.

This thesis will investigate the relationship between naval air logistics and strategy, national economics, operations and tactics and therefore is organised under five main themes. Firstly, to examine the naval air expansion programmes, especially in the Second World War, from which other requirements stemmed. Secondly, to relate naval strategy to the needs for naval air stations, a topic frequently ignored by many authors who give more consideration to aircraft carriers. Thirdly, to address how successful was aircraft production in meeting the requirements laid down in the expansion programmes. Fourthly, the co-ordination of resources, be they ships or squadrons, for operations and fifthly, from the tactical perspective the difficulties of maintaining aircraft in the front line. The conclusion includes an appreciation of comparisons between naval aviation during the two World Wars and a summary of the air logistics of the British Pacific Fleet in 1945 when many earlier developments came to fruition.

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List of Abbreviations

1 st ACS	First Aircraft Carrier Squadron
11 th ACS	Eleventh Aircraft Carrier Squadron
AC30	30th Aircraft Carrier Squadron
A/C	Aircraft
ACAS	Assistant Chief of the Air Staff
ACAS (F)	Assistant Chief of the Air Staff (Fighters)
ACAS (Ops)	Assistant Chief of the Air Staff (Operations)
ACC	Air Service Construction Corps
ACNS	Assistant Chief of the Naval Staff
ACNS (A)	Assistant Chief of the Naval Staff (Air)
ADM	Admiralty Papers, National Archives, Kew
ADOD	Assistant Director of Operations Division
A D of P (A)	Assistant Director of Plans (A)
Air Fitter (A)	Air Fitter (Airframes)
Air Fitter (E)	Air Fitter (Engines)
Air Fitter (L)	Air Fitter (Electrical)
Air Fitter (O)	Air Fitter (Ordnance)
AIR	Air Ministry Papers, National Archives, Kew
AL	Admiralty Library, MoD, Portsmouth
AOC	Air Officer Commanding
AOC-in-C	Air Officer Commanding-in-Chief
ASEC	Air Stores Establishment Committee
A/S	Anti-submarine
ASC	Aircraft Supply Committee
ASV	Air-to-surface vessel radar
ASIS	Air Store Issuing Ship
ATA	Air Transport Auxiliary
ATE	Artificer Training Establishment
BAD	British Admiralty Delegation, Washington
BEF	British Expeditionary Force
BPF	British Pacific Fleet
C-in-C	Commander-in-Chief
C-in-C, WA	Commander-in-Chief, Western Approaches

CAB	Cabinet Papers, National Archives, Kew
CAG	Carrier Air Group
CAM	Catapult Armed Merchantman
CAP	Combat Air Patrol
CAS	Chief of the Air Staff
CEC	Construction and Equipment Committee
CE-in-C	Civil Engineer-in-Chief
CID	Committee of Imperial Defence
CNAS	Chief of the Naval Air Service
CNR	Chief Naval Representative, Ministry of Aircraft Production
CO	Commanding Officer
CRO	Civilian Repair Organisation
CV	Fleet Carrier
CVE	Escort Carrier
CVL	Light Fleet Carrier
DACR	Director of Aircraft Carrier Requirements
DAD	Director of Air Division
DAE	Director of Aircraft Equipment
DAM	Director of Air Material
DAMR	Director of Aircraft Maintenance and Repair
DAS	Director of Air Services
DASD	Director of Anti-Submarine Division
DAWT	Director of Air Warfare and Flying Training
DBR	Dive Bomber Reconnaissance
DCAS	Divisional Commander of Air Stations
DCNS	Deputy Chief of the Naval Staff
DC (S)	Defence Committee (Supply)
DF Ops	Director of Operations, Fighter Command
DGAAW	Director of Gunnery and Anti-Aircraft Warfare
DGNPD	Director General of Naval Development and Production, Ministry of Aircraft Production
DGSM	Director General of Servicing and Maintenance, Air Ministry
DNAD	Director of Naval Air Division
DNAO	Director of Naval Air Organisation
DNC	Director of Naval Construction

DNO	Director of Naval Ordnance
DPS	Director of Personal Services
DOD	Director of Operations Division
DOD H)	Director of Operations Division (Home)
DOD (F)	Director of Operations Division (Foreign)
D of P	Director of Plans
DD of P	Deputy Director of Plans
D of S	Director of Stores
DTD	Director of Trade Division
E-in-C	Engineer in Chief
EMS	Eastern Mediterranean Station
ERA	Engine Room Artificer
FAA	Fleet Air Arm
FAAM	Fleet Air Arm Museum, Yeovilton
FAE	First Line Aircraft Establishment
FAMG	Fleet Air Maintenance Group
FOC	Flag Officer Commanding
FOCT	Flag Officer Carrier Training
FOIC	Flag Officer-in-Command
FONAS	Flag Officer Naval Air Stations
FRU	Fleet Requirements Unit
GOC	General Officer Commanding
HP	Horsepower
HQ	Headquarters
HMA	His Majesty's Airship
HMS	Her/His Majesty's Ship
IO	Indian Ocean
IWM/SA	Sound Archive, Imperial War Museum, Lambeth
IWM/Doc	Department of Documents, Imperial War Museum, Lambeth
JAWC	Joint Air Warfare Committee
MAC	Merchant Aircraft Carrier
MAP	Ministry of Aircraft Production
MATMU	Mobile Air Torpedo Maintenance Unit
MM	Mobile Maintenance Component
MNAO	Mobile Naval Air Organisation

MONAB	Mobile Naval Air Base
MS	Mobile Servicing Component
MSR	Mobile Serving and Repair Unit
MUN	Ministry of Munitions Papers, National Archives, Kew
NAS (N)	Naval Air Stations (North)
NASU	Naval Aircraft Salvage Unit
NCXF	Naval Commander, Expeditionary Force
NHB	Naval Historical Branch, MoD, Portsmouth
NMM	National Maritime Museum, Greenwich
PREM	Prime Ministerial Papers, National Archives, Kew
RA	Rear Admiral
RAA	Rear Admiral Aircraft Carriers
RANAS	Rear Admiral Naval Air Stations
RATOG	Rocket Assisted Take-off Gear
RCAF	Royal Canadian Air Force
RDU	Receipt and Dispatch Unit
RFC	Royal Flying Corps
RN	Royal Navy
RNARY	Royal Naval Aircraft Repair Yard
RNAS	Royal Naval Air Service (1914-1918 only)
RNAS	Royal Naval Air Station
RNATE	Royal Naval Apprentice Training Establishment
RNM	Royal Naval Museum, Portsmouth
RNZAF	Royal New Zealand Air Force
RME	Royal Marine Engineers
RNTE	Royal Naval Training Establishment
RNVR	Royal Navy Volunteer Reserve
SAC	Superintendent of Aircraft Construction
SAAF	South African Air Force
SEAC	South East Asia Command
SME	Squadron Mobile Equipment
SO	Senior Officer
SNO	Senior Naval Officer
SS	Submarine Scout Airship
SSU	Squadron Servicing Unit

SW	South West
TAMY	Transportable Aircraft Maintenance Yard
TBR	Torpedo Bomber Reconnaissance
UK	United Kingdom
US	United States
USA	United States of America
USN	United States Navy
USS	Under Secretary of State
USS	United States Ship
VA	Vice Admiral
VAC	Vice Admiral Commanding
VA EMS	Vice Admiral, Eastern Mediterranean Station
VACEC	Vice Admiral Commanding, East Coast
VACEM	Vice Admiral Commanding, Eastern Mediterranean
VCAS	Vice Chief of the Air Staff
VCNS	Vice Chief of the Naval Staff
WA	Western Approaches
W/T	Wireless telegraphy

Chapter 1 – Introduction: Logistics of Naval Air Power

Naval air power – an overview

The history of air power in the Royal Navy (RN) is one of great contrast. Few military organisations have been on such a rollercoaster ride. A world leader during the First World War in the use of seaplane carriers, the development of the modern aircraft carrier, a pioneer of strategic bombing and responsible for large numbers of aircraft in ground attack and air superiority roles on the Western Front, the Royal Naval Air Service (RNAS) was the senior air service, as the Royal Navy had been the Britain's Senior Service for centuries. Twenty years later the Fleet Air Arm (FAA) went on to achieve global power projection capability during the Second World War escorting convoys, striking against enemy fleet units and land targets, providing fighter cover for fleet operations and an air umbrella for amphibious landings. The wartime carrier building programme set in motion in 1942¹ came to fruition in a powerful carrier force with world class aircraft during the late 1950s and early 1960s, whilst the cornerstone of the 1998 Strategic Defence Review was the construction of a new generation of aircraft carriers, the largest vessels in the history of the Royal Navy, the first to enter service in 2015.

There is a marked disparity with the disjointed organisation of dual control in the inter-war period and the decade of uncertainty following the cancellation of new carrier CVA-01 in 1966, when the future of naval air power, although not in doubt per se, was afforded a lower priority and morale in the service was affected accordingly. Even today the government is giving out mixed signals by deciding to withdraw the Sea Harrier FA2 fighter from service; between 2006-2015 the Royal Navy will be without indigenous fighter cover for only the second time since the installation of launching platforms aboard capital ships in the First World War.² National priorities, to rationalise the air forces in 1918 and withdraw from East of Suez in the 1960s, naturally overrode the purely military arguments. It took the Fleet Air Arm a considerable time to recover from both episodes and once again place itself at the forefront of naval operations; largely inevitable from the purely naval standpoint given that aircraft became a dominating feature of naval power during the twentieth century. A century on from HMS *Dreadnought* it is the American

¹ Aircraft Carriers: Fleet requirements and Board Specifications. Admiralty conference, proposed expansion of wartime building programme, comparison of naval strengths of USA and Japan, 1936-1942, ADM 1/11971, National Archives, Kew. [Further references to National Archives sources will include only departmental letter codes and series numbers]

² The other occasion being December 1978 – February 1981 between the withdrawal of the Phantoms of 892 Squadron aboard HMS *Ark Royal* and the Harriers of 800 Squadron becoming operational on HMS *Invincible*. For details of post-war aircraft see David Hobbs, *Aircraft of the Royal Navy since 1945*. (Liskeard: Maritime Books).

Nimitz Class aircraft carrier which is now *the* capital ship with the same requirement for a huge industrial base to support it.

The overwhelming amount of coverage on naval air power, in common with naval and military affairs more generally, is afforded to operations. Comparatively little research has taken place on the creation and maintenance of naval air power during the World Wars. In both conflicts the air services expanded enormously from a small base and made great strides in training, equipment, tactics and doctrine under the pressure of wartime exigencies, especially between 1939-1945 when air power played a far more pivotal role. At the outbreak of war in 1914 the RNAS possessed between 93-95 land and seaplanes, six airships, two balloons and 727 personnel.³ Upon the formation of the Royal Air Force (RAF) on 1 April 1918 there was a veritable armada of 2,949 aircraft, 111 airships, 200 balloons and 55,066 officers and other ranks.⁴ A numerical comparison with the FAA in World War Two is somewhat superficial, not least because of its significantly different duties, but it is worth bringing to the reader's attention at an early stage; the seven aircraft carriers, four naval air stations, 609 aircraft and 5,300 officers and men on the books in 1939 had expanded to 81 carriers, 71 bases, 4024 'planes and 84,000 personnel by August 1945.⁵ The massive effort in planning, procurement and deployment which changed the two organisations beyond recognition has tended to take a back seat in lieu of coverage of operations.

The most widely neglected statistic in the latter set of figures is the dramatic increase in the number of naval air stations. In the First World War, before the advent of the true aircraft carrier, almost the entire RNAS was land-based. Even since then, when aircraft carrying ships and their aircraft have been the cutting edge of the service, and in Britain the responsibility for land-based maritime air power has rested with Coastal Command of the RAF since 1918, the whole basis of the air service has rested upon its facilities ashore required for basic training, the formation and working up of squadrons, disembarked formations and aircraft maintenance. On returning to port, operational squadrons fly off to a shore base to rest, reorganise and repair. If operations in a new theatre were to be entertained, the provision of air stations was essential prior to the carriers' arrival, although not often possible in wartime to an ideal standard. Fortunately in the Second World War the assistance afforded by the RAF and other Allied air forces

³ The naval arm of the Royal Flying Corps became the Royal Naval Air Service in July 1914.

⁴ R.D. Layman, *Naval Aviation in the First World War: Its Impact and Influence* (London: Chatham Publishing, 1996), 205.

⁵ Figures compiled by Royal Navy's Historical Section, 25 June 1962 (copy held by Naval Historical Branch, Portsmouth).

negated the necessity of a large airfield building programme which would have probably proved impossible given the shortages of manpower, resources and time. The enormous effort expended on expanding the FAA into a worldwide organisation was rewarded before the end of hostilities when it was presented with an opportunity in the Pacific to demonstrate its full logistic potential which is explored in Chapter 7.

Logistics and the Royal Navy

The Pacific campaign during 1945⁶ was the Royal Navy's only campaign in the Second World War where the logistics have attracted significant attention, essentially because the extensive requirement for support afloat – the Fleet Train – made it such an obvious break with previous British practice.⁷ Former Head of the Naval Historical Branch, David Brown summarised the strategic situation which dictated the Navy's operating conditions until the last year of the war:

‘The availability of suitable ports under British, Dominion or Allied control in the RN's principal theatres of operations and the nature of the war – defensive up to the end of 1943 and an offensive against accessible areas thereafter – meant that the relatively short range of British Fleet units was not a major handicap and there was no immediate requirement to acquire either the expertise or the specialised equipment needed for at sea replenishment of a modern Fleet.’⁸

It is understandable that authors regard the logistic provision in the early war years as simply a continuation of the system which had largely been in place in the inter-war era. The lack of interest in logistics is demonstrated by the fact that in the official history of the naval war against Japan there is no mention of logistic shipping for the Eastern Fleet's operations in the spring of 1942, although the support ships with the Japanese Fleet are listed.⁹ The only official history solely on British naval logistics, albeit unpublished, covered the Fleet Train, the navy's support afloat which played a relatively

⁶ For the Royal Navy: Operation Iceberg, 25 March - 20 April and 1–25 May 1945; July and August Operations, 17 July – 13 August 1945. For coverage of the operations see ADM 199/590, 199/591 and 199/1478.

⁷ The discussion here does not encompass amphibious operations which are combined in nature and not purely naval; the logistics of Operation Overlord and the American island hopping campaign in the Pacific have both received significant attention.

⁸ David Brown, ed, *The British Pacific and East Indies Fleets: 'The Forgotten Fleets' 50th Anniversary* (Liverpool: Brodie Publishing, 1995), 88.

⁹ Naval Historical Branch, Ministry of Defence, *War with Japan: Volume II* (London: HMSO, 1995), 120-129.

minor role until 1945.¹⁰ As David Brown suggests, regarding port facilities, the continuation of the pre-war logistic support structure was largely true. The one great exception for the Royal Navy was the FAA, since it was the RAF that remained in control of all air bases and provided all the maintenance personnel until May 1939.

The major logistic requirements in the Pacific were refuelling and the supply of aircraft. These receive far greater attention because the failure to deliver sufficient quantities of both at times threatened to seriously impair the fleet's viability and the Admiralty was made fully aware of the difficulties encountered in the case of the latter in the report on the British Pacific Fleet's (BPF's) experience in March 1946: 'Reports previously forwarded will have made it clear that the lack of air stores came nearer to causing a complete breakdown in operations than any other single factor.'¹¹ Operations were on such a scale that separate commands were established with Rear Admiral Portal, the Flag Officer Naval Air Pacific (FONAP), based in Melbourne assuming responsibility for the Navy's air organisation within the theatre; Vice Admiral Charles Daniel, Vice Admiral Administration (Q), being in overall charge of the Pacific logistics effort. In effect the organisation in the Pacific was an FAA in miniature and this organisation was dependent upon support from the Navy's network of air bases worldwide in Britain, the United States, South Africa and Ceylon which had built up throughout the war. This example demonstrates the ultimate development of British naval air power during the World Wars in terms of the size of forces deployed, power projection capability and ability to sustain operations through a complex system of land bases and support afloat.

Indeed it was through the study of the BPF's air operations that the author first became aware of the key elements and importance of air logistics.¹² Because, as mentioned above, the logistic problems threatened the continuation of the campaign, it is perhaps the most obvious place to start in an analysis of naval air logistics of the period. Following the completion of this study it became apparent that little research had been undertaken on this subject earlier in the Second World War. The air logistics of the BPF had largely been regarded in isolation, which they clearly were not, rather than as the result of a series of developments since 1939.

As indicated by the numerical summary, the events in the Pacific marked the culmination of a period of rapid wartime expansion for the FAA just as the RNAS had

¹⁰ Captain R.F. Leonard, *History of the Fleet Train, 1936-1945*, Naval Historical Branch, Portsmouth [Further references to the Naval Historical Branch will be referred to as NHB] T1884.

¹¹ Report of the Experience of the British Pacific Fleet, Jan - Aug 1945, Part II, ADM 199/1457.

¹² B. Jones, 'Triumph over adversity: The Fleet Air Arm in the Far East, 1944-1945.' MPhil. Diss (University of Birmingham, 1999).

experienced between 1914-1918. On both occasions the air organisations started the conflict at low ebb. At the beginning of the First World War the delivery vehicle, the aircraft, had been in existence for a little over ten years and integration with the rest of the navy was in its infancy. The return of the FAA to naval control in May 1939 ended a period of unprecedented neglect and confusion resulting in the loss of its status as the world leader in the 1930s, and most crucially the chaotic nature of aircraft construction and procurement which bedevilled the service until the final year of the war. Without enormous material assistance from the United States the large-scale expansion of the FAA would have not taken place in wartime at all.

In addition to an analysis of the development of the two naval air organisations, it is crucial to place the logistics of air power within the context of those for the Royal Navy as a whole. Amidst the literature on the Royal Navy there is a relative dearth of interest in the logistics, though more material on traditional requirements such as dockyards and victualling. The operational freedom afforded in the era of the wooden walls, when ships did not have to refuel enabling them to undertake long blockades, ended with the introduction of the steam engine. However, the establishment of a worldwide network of coaling stations, also utilised as communication bases for the undersea telegraph system, allowed the Royal Navy to achieve a global reach, despite the short ranges of its vessels, unmatched by any nation: ‘...with the conversion to coal and steam power, a ship’s endurance was once again limited. But they could still carry their ammunition and supplies farther and faster, and were thus more logistically independent than horse-powered armies, despite the need for coaling stations.’¹³ Before the First World War the Royal Navy adopted oil as a more convenient and superior method of powering its vessels, although supplies were initially limited. The Royal Navy’s logistical prowess was not matched until the United States Navy’s Service Squadrons pioneered extensive support afloat in the Pacific during the latter years of the Second World War.

Logistics literature review

A revival in the historiography of logistics in warfare was heralded by Martin van Creveld’s pioneering work *Supplying War* in 1977 when he highlighted the unpopularity of logistic subjects:

‘Hundreds of books on strategy and tactics have been written for every one on logistics, and even the relatively few authors who have bothered to investigate

¹³ David M. Moore, Jeffrey P. Bradford and Peter D. Antill, *Learning from past defence logistics experience: Is what is past prologue*, (London: RUSI, 2000), 4.

this admittedly unexciting aspect of war have usually done so on the basis of a few preconceived ideas rather than on a careful examination of the evidence.’¹⁴

While the arguments have moved on somewhat since, many writers still take logistics for granted and view the ‘unexciting aspect’ pointed out by van Creveld as a sign that there will be no market for work in this field. In the history of British naval air power, the concentration on logistics, mainly in the sense of national economics, shipbuilding and aircraft production, has been in the inter-war period. There are significant works by Hone, Friedman and Mandeles, and Geoffrey Till on British naval air logistics examining the effect dual-control had at all levels of the Fleet Air Arm in the inter-war period.¹⁵ Andrew Gordon also gave coverage to the problems encountered by the F.A.A. in the field of aircraft procurement during the period of rearmament.¹⁶ In *Airpower and the Royal Navy 1914-1945*, Till did cover developments in the Second World War, but on a general level rather than the detailed decision making process to be examined in Chapter Two.

The most significant American works on naval logistics in the Second World War; Ballantine’s *U.S. Naval Logistics in the Second World War* and Carter’s *Beans, Bullets, And Black Oil* were written by practitioners after the end of the conflict.¹⁷ They were reprinted in the late 1990s by the Naval War College at Newport for teaching purposes as part of their Logistic Leadership Series. The fact that such works were not produced on the Royal Navy is probably a recognition of the scale of the logistic hurdles faced and overcome by the United States Navy (USN). Whereas naval logistics had undergone a revolution for the Americans, that was not the case with the Royal Navy, except for its Pacific operations in 1945.

Rear Admiral ‘Nick’ Carter, author of *Bullets, Beans and Black Oil*, a history of American naval logistics during the Pacific campaign put the case for logistics in characteristically blunt fashion: ‘...those interested in naval history may realize that naval warfare is not all blazing combat.’¹⁸ Indeed since so many authors have ignored the logistic sphere, for many it may well have come to be regarded as an acceptable norm.

¹⁴ Martin van Creveld, *Supplying War: Logistics from Wallenstein to Patton* (Cambridge: Cambridge University Press, 1977), 231.

¹⁵ Thomas C. Hone, Norman Friedman and Mark D. Mandeles, *American & British Carrier Development 1919-1941* (Annapolis, MD.: Naval Institute Press, 1999); G. Till, *Airpower And The Royal Navy 1914-1945: A Historical Survey* (London: Jane’s, 1979)

¹⁶ Andrew Gordon *British Seapower and Procurement between the Wars: A Reappraisal of Rearmament* (London: Macmillan, 1988)

¹⁷ Duncan S. Ballantine, *U.S. Naval Logistics In The Second World War* (Princeton: Princeton University Press, 1947; reprint, Newport: Naval War College Press, 1998); Worrall Reed Carter, *Beans, Bullets, And Black Oil: The Story Of Fleet Logistics Afloat In The Pacific During World War II*. (Washington, D.C.: U.S. Government Print Office, 1953; reprint, Newport, R.I.: Naval War College Press, 1998)

Prominent strategist Colin Gray reinforces van Creveld's theory that there is a problem with 'pre-conceived ideas':

'Military history is full of examples of great adventures which appeared to triumph over logistical frailty, and other great adventures which were brought to nought apparently because of those frailties. In short, history yields ever-arguable 'evidence' in abundance to illustrate any position in argument a scholar prefers to take.'¹⁹

This trend might be a product of historians knowing the results of campaigns before selecting their arguments and not researching the logistic aspects as much as they might and, as already suggested, taking them for granted. John Lynn has argued that van Creveld was guilty of choosing his evidence to support his theory on the weakness of logistical planning:

'It would not have been so easy for van Creveld to criticize the foibles of planners and praise the logistic improvisations of field commanders if he had considered the successful U.S. central Pacific campaign of 1942-1945, especially when contrasted with the failure of the German onslaught to defeat the Soviet Union in 1941.'²⁰

Land, sea and air logistics

Further to a general neglect of logistics, most authors on the subject have focussed upon military rather than naval or air force matters. Since wars are ultimately decided by land forces this is perhaps not surprising, but Lawrence Freedman espoused a more fundamental reason: '...[although] it is a practical art that must be mastered by navies and air forces as well, there is something distinctive about logistics in land warfare in that it requires territory to be held once taken, over an extended period.'²¹ Moreover, for centuries military commanders depended for much of their supplies upon local resources – living off the land – as it was more problematic to transport significant quantities of stores on land than by sea which is still the case today; as Julian Thompson commented: 'What is also distinctive, and therefore interesting, about logistics in land warfare is that they are,

¹⁸ Carter, *Beans. Bullets and Black Oil*, xxxv.

¹⁹ Thomas M. Kane, *Military Logistics and Strategic Performance* (London: Frank Cass, 2001), ix.

²⁰ John A. Lynn, 'The History of Logistics and Supplying War' in John A. Lynn, ed., *Feeding Mars* (San Francisco: Westview Press, 1993), 14.

²¹ Julian Thompson, *Lifblood of War: Logistics In Armed Conflict* (London: Brasseys, 1991), xvi.

to put it crudely, more difficult.’²² Since ships carry the supplies for their crews, the individual units and the naval organisation as a whole have to possess a greater awareness of logistic needs; in a similar fashion to desert warfare all of the provisions must be delivered by the logisticians; there was no prospect of living off the land: ‘The need to carry all requirements from the outset of a voyage meant that logistics at sea reached a high level of administrative complexity and efficiency long before this was achieved in land warfare.’²³

The British Maritime Doctrine of the mid 1990s observed the relative ease with which naval logistics is carried out on a day-to-day basis means the recipients are not as aware of supply problems as their military counterparts: ‘Indeed the sailor is so used to the level of organic logistic support that is provided routinely in ship and its tactical formation that logistic considerations are intrinsic to maritime doctrine.’²⁴ Since warships have traditionally been the most complex and costly weapon systems and the dockyards built to support them were the biggest and technologically advanced industrial complexes, navies achieved a sophistication long before their land based counterparts; for example the skill required to command a warship saw the buying of commissions stopped in the navy centuries before the army and while patronage was still important it was the quality of the officer which counted above all else. But what has recently applied to authors of military history, a focus on strategy and tactics, also applied in the case of United States Naval officers before 1941 according to Vice Admiral George Dyer: ‘...the officers of the Line of the Navy had taken only a cursory interest in logistics in the years before World War II. This occurred because...there were few really large difficult logistical problems demanding command decisions.’²⁵ By the time Duncan Ballantine wrote his volume on *U.S. Naval Logistics in the Second World War* in 1947 and with the experience of that conflict still fresh, the necessity for training in strategy, tactics *and* logistics was more widely understood:

‘The persistence of this neglect of logistics bears witness to the long dominance exercised over naval minds by a too narrow definition of strategy and tactics... In modern times it is a poorly qualified strategist or naval commander who is not

²² Ibid, xvi.

²³ Lynn, ‘The History of Logistics and Supplying War’, 13-14.

²⁴ Ministry Of Defence, *The Fundamentals of Maritime Doctrine BR1806* (London: HMSO, 1995), 93.

²⁵ Kenneth Macksey, *For Want of a Nail: The Impact On War Of Logistics And Communications* (London: Brassey’s, 1989), 122.

equipped by training and experience to evaluate logistic factors or to superintend logistic operations.’²⁶

Levels of logistic provision

An analysis of the different levels of logistic provision is crucial for an understanding of the manner in which the problems of supply were influenced by and impact upon national strategy, economic planning, operational effectiveness and tactical manoeuvres. Henry Eccles summarised the wide application of the term: ““Logistics” is merely a convenient term used to encompass the problem of controlling all the “means of war” as appropriate at various levels of command.’²⁷

Thomas Kane has argued that since many authors have concentrated upon one of these areas, the logistic debate as a whole has tended to lack a core focus: ‘Although most commentators lament what they see as an absence of interest in logistics, a review of the relevant literature reveals not so much a dearth of material as a lack of direction.’²⁸ Kane regards the impact of logistics on strategy as of key importance and believes it is in the strategic freedom that is conferred on the commander by logistic superiority, which is where the real significance of the supply conundrum lies, rather than on the battlefield itself as authors such as van Creveld have espoused. In his only chapter concerned with naval warfare, the American campaign in the Pacific during the Second World War, Kane noted that American logistics enabled an early counterattack to nullify Japanese tactical advantages and Allied industrial strength could be brought to bear upon the Japanese at any point in their defensive system through the flexibility afforded by amphibious and carrier task forces supported by an enormous organisation of shore bases and supply vessels.²⁹ Kenneth Macksey was in full agreement with this view: ‘...the Japanese were confronted by an enemy with an immensely superior logistic strategy and capability, such as they had never contemplated when setting up their perimeter defences...’³⁰ The problem with Kane’s argument is that to concentrate just on the relationship between strategy and logistics is to miss the linkage to the other facets of logistics; national economics, operations and tactics. For example Britain’s Far Eastern strategy during the Second World War demanded that large naval air forces should be established in the Indian Ocean, but was hindered by the lack of resources to build the necessary bases and

²⁶ Ballantine, *U.S. Naval Logistics in the Second World War*, 5.

²⁷ Henry E. Eccles, *Logistics in the National Defense, Logistics In The National Defense* (Harrisburg: Stackpole, 1959; reprint, Newport, R.I.: Naval War College Press, 1997), 10.

²⁸ Kane, *Military Logistics and Strategic Performance*, 2.

²⁹ *Ibid*, 69.

³⁰ Macksey, *For Want of a Nail*, 139.

supply the carriers and aircraft. Anyway a large proportion of the available resources were diverted operationally to the Mediterranean and as Admiral Somerville recognised in early 1942, tactically the numbers and types of aircraft in the fleet were wholly inadequate for fighting the Japanese.

Bearing in mind that both world wars are under consideration, it is a key question how the chronology and the levels of logistics can be successfully entwined. It is intended that the experiences of the air services during the two world wars will be compared within five major themes. Firstly, to examine the naval air expansion programmes, especially in the Second World War, from which other requirements stemmed. Secondly, to relate naval strategy to the needs for naval air stations. Thirdly, to address how successful aircraft production was in meeting the requirements laid down in the expansion programmes. Fourthly, the co-ordination of resources, be they ships or squadrons for operations and fifthly, from the tactical perspective the difficulties of maintaining aircraft in the front line. The final chapter includes a summary of the air logistics of the BPF in 1945 when many earlier developments came to fruition and an appreciation of the comparisons between naval aviation during the two World Wars.

Air logistics and strategy

Strategy was important at two levels, naval strategy which dictated the naval air expansion programmes and national strategy which dictated where the navy would have to fight. The expansion programmes were subject to economic limitations as Henry Eccles explained: 'In terms of general principles...*economic* capabilities limit the combat forces which can be *created*. At the same time, *logistic* capabilities limit the forces which can be *employed* in combat operations. Thus, it is obvious that economic-logistic factors limit strategy.'³¹ Planning at national level was especially fraught due to its inter-Allied nature. Each country would draw up a list of possible operations many of which were then cancelled at Allied conferences; in *Grave of a Dozen Schemes*, Ned Willmott recounted the 'Alice-in-Wonderland' characteristics which applied to much British planning in the Far East between 1943-1945.³² John Ehrman's volume on *Grand Strategy* from the same period identified the lack of shipping as the key strategic arbiter:

'As recently as May 1943, the highest British authorities had concentrated specifically on shipping as the most pressing limit on strategy. It was at that time,

³¹ Eccles, *Logistics in the National Defense*, 41.

to the Prime Minister, “the measure of all our operations”; to the C.I.G.S., “the stranglehold on all our operations”; while to the First Sea Lord of the Admiralty, it “will, and does indeed already restrict our whole offensive strategy.”³³

In the spring of 1938 an Admiralty Committee considering the possible logistic requirements of the Eastern Fleet, excluding oilers and not mentioning the FAA, recommended that a total of seventy-two repair and supply ships would be needed.³⁴ It was unsurprising, therefore, that: ‘By 1941...when the Eastern War began, the shipping situation did not permit of more than a fractional implementation of the recommendations for such a war and all requirements had to be restated of their merits as they arose.’³⁵ The need to prioritise British shipbuilding capacity most directly affected the FAA in the need to delay the completion the Fleet Carriers *Indefatigable* and *Implacable* until 1944, despite a shortage of carriers caused by early losses. The FAA required a relatively small number of specialist ships for logistic support, the repair and maintenance of aircraft, but only one-third were in service by the end of the war.

Norman Friedman’s *British Carrier Aviation: The Evolution of the Ships and their Aircraft* provides unsurpassed coverage of the carrier programmes throughout both world wars and the inter-war years.³⁶ The only criticism, perhaps churlish given the level of detail that Friedman affords, is that he does not use many footnotes to indicate which of the sources, from the extensive list in the bibliography, are related to the text. It is necessary to cover the carrier programme in some detail in the following chapter as this formed the basis for the air expansion programme and therefore aircraft production requirements. For carrier development during World War I, there is also useful coverage in David K. Brown’s *Grand Fleet*, R.D. Layman’s *Before the Aircraft Carrier* and P.M. Rippon’s *Evolution of Engineering in the Royal Navy, Volume I*.³⁷ For details of the carriers and the specifications of individual vessels there can be no better reference work than David Hobbs’ *Aircraft Carriers of the Royal and Commonwealth Navies*.³⁸

³² H.P. Willmott, *Grave of a Dozen Schemes: British Naval Planning and the War against Japan, 1943-1945* (London: Airlife Publishing, 1996)

³³ John Ehrman, *Grand Strategy Volume V August 1943 – September 1944* (London: HMSO, 1956) 26-27.

³⁴ Captain R.F. Leonard, *History of the Fleet Train*, NHB T1884, 2.

³⁵ *Ibid*, 3

³⁶ Norman Friedman, *British Carrier Aviation: The Evolution of the Ships and their Aircraft* (London: Conway Maritime Press, 1988).

³⁷ David K. Brown, *The Grand Fleet: Warship Design and Development 1906-1922* (London: Chatham Publishing, 1999); R.D. Layman, *Before the Aircraft Carrier, The Development of Aviation Vessels 1849-1922* (London: Conway Maritime Press, 1989), 33-81; Commander P.M. Rippon, *Evolution of Engineering in the Royal Navy, Volume I: 1827-1939* (Tunbridge Wells: Spellmount Ltd, 1988), 185-194.

³⁸ David Hobbs, *Aircraft Carriers of the Royal and Commonwealth Navies: The Complete Illustrated Encyclopedia from World War I to the Present*. London: Greenhill Books, 1996.

What remains outside Friedman's extensive remit is the need for naval air stations, an essential requirement not only for training, but supporting operations worldwide. The manner in which the vital contribution played by airfields as the key basing requirement for naval air power has been largely ignored has already been raised in this paper. Aircraft are the only naval weapon system with a separate basing requirement; the Royal Navy's great industrial complexes of Chatham, Portsmouth and Plymouth which for centuries maintained ships from wooden walled Ships-of-the-Line to nuclear powered ballistic missile submarines are largely irrelevant when it comes to maintaining aircraft. This limitation was similarly applicable to the facilities around the world including Bermuda, Gibraltar, Malta and Singapore. Jon Sumida highlighted the British complexes as the basis of naval logistics in 1914: 'The navy, which was the world's largest, depended upon an extensive complex of steel works, engineering workshops, ordnance foundries, and dockyards for the manufacture, repair, and maintenance of its ships and associated equipment.'³⁹ The carriers themselves, of course, required the same repair and maintenance facilities, plus victualling, ammunition, stores and personnel requirements but also needed the facilities for the aircraft. Kenneth Macksey noted the shifting priorities during World War One:

'...by mid-1915 air warfare was beginning to absorb a significant slice of the logistic cake as its capabilities were extended from simple reconnaissance to a wide variety of roles at sea and over land... Behind every front a complex of airfields, headquarters, anti-aircraft artillery, communication networks, maintenance and repair depots sprang up and was imposed upon the traditional logistic services – to raise further the demand for skilled, high grade personnel in competition with the other combat arms and services.'⁴⁰

National policy, in the form of the dual control arrangement since 1918, resulted in serious logistical consequences for the Fleet Air Arm in 1939 as it possessed few shore facilities in the United Kingdom and none abroad at all. There was little that could be done immediately to improve the situation overseas because of the lack of resources and the need to build up a firm base in Britain. Vice Admiral Tom Phillips, the Vice Chief of the Naval Staff, recognised the crucial importance of an air station network during discussions on the defence of Singapore in November 1940:

³⁹ Jon Sumida, 'Forging the Trident, British Naval Industrial Logistics 1914-1918', in John A. Lynn, ed., *Feeding Mars* (San Francisco: Westview Press, 1993), 217.

³⁹ Kane, *Military Logistics and Strategic Performance*, 2.

‘Sea power depends on adequate bases and facilities all the world over. For surface ships that has been the policy for generations, and the development of air power in the present generation likewise depends upon the facilities to give the Air Forces the necessary mobility.’⁴¹

More than five years later, in his letter accompanying a report on the hitherto unique experience of the BPF, Admiral Bruce Fraser came to very much the same conclusion:

‘In ocean warfare, where ships do long spells away from their main bases, it is essential that adequate shore air facilities are available to accommodate disembarked Carrier Air Groups... We are accustomed in the Navy to find docking and repair facilities for ships at main bases; shore air accommodation for Carrier Air Groups from the carriers is just as much as part of the base as are the other facilities.’⁴²

It is fascinating that Fraser, Britain’s most senior sea-going admiral at the end of the war, felt the need to restate the basic requirements of a cornerstone of the Service, although as highlighted earlier in this chapter the navy’s Pacific operations brought air requirements to a new level. The ability to construct air facilities abroad at short notice was not achieved at any time in the war primarily due to the lack of construction personnel. It was planned to allocate 3000 Royal Marines Engineers to the Pacific in the summer of 1945,⁴³ but the Mobile Naval Air Bases upon which Fraser’s forces depended were based at airfields loaned by the Royal Australian Air Force and the USN. It was a constant struggle to obtain airfields from the Air Ministry, United States Navy, Australian and South African Air Forces and other Allied nations because of the FAA’s meagre indigenous resources.

It was vital that the various logistic aspects were co-ordinated to position naval air squadrons with the right types of aircraft, either land-based or ship-borne, to carry out the requirements demanded of them as part of the wider strategic plan. However, as Hone, Friedman & Mandeles concluded in the case of the United States Navy: ‘... improvements in carrier defenses, added to an increase in the number of large, fast carriers, did not produce a weapon with *strategic* impact.’⁴⁴ For the long and sustained operations in the Pacific, the network of air bases and support ships was essential to maintain the American

⁴⁰ Macksey, *For Want of a Nail*, 73.

⁴¹ Memorandum by Air Branch on meeting to be held on ‘Naval Air Requirements in Singapore area’, 10 November 1940, ADM 1/11850.

⁴² Report of Experience of BPF, Jan to Aug 1945, Part II, ADM 199/1457.

⁴³ Monthly report ‘State of Fleet Air Arm’ by Air Branch, Jun 1945, ADM 116/5534.

Carrier Task Forces in action. On the grand strategy scale, Duncan Ballantine observed that Operation 'Overlord' and the assault on the Marianas Islands only nine days apart: 'The launching of a full scale offensive in all theatres of war in 1944 brought the accompanying logistic effort into its mature phase, a phase in which three dominant factors – distance, magnitude and uncertainty – conditioned the character of logistic effort.'⁴⁵ Such co-ordination could only be achieved by settled plans and huge logistic support to maintain them, especially in this case where two amphibious operations were being launched. Keeping the initiative was necessary for achieving the former and in the early years of the war this had proved impossible when Axis forces had the upper hand.⁴⁶

Air logistics and national economics

Given the small size of the air organisations at the beginning of the World Wars, the allocation of adequate resources within the national economy strategy was vital, probably more so between 1939-1945 when air power was considerably more important as the Norwegian campaign in the spring of 1940 amply demonstrated.⁴⁷ Duncan Ballantine clearly saw the significance of national economy in military potential: 'As the link between the war front and the home front the logistic process is at once the military element in the nation's economy and the economic element in its military operations.'⁴⁸ Henry Eccles succinctly captured this view: 'Logistics is the bridge between our national economy and the actual operations of our combat forces in the field.'⁴⁹ The supply system at national economic level in wartime was a fundamentally different environment as Ballantine pointed out: 'The logistic process in total war must operate in an economy saturated by demand, in which the ordinary laws of the marketplace are in suspension, in which the factor of time supercedes price and the greatest evil is to have "too little, too late"'.⁵⁰

The allocations for the RNAS or the FAA cannot be viewed in isolation, but as an element of the Senior Service as a whole. Within the context of national strategy and economy there will always be fierce competition for finance, resources and manpower between the three Services. A study of naval air logistics offers a unique opportunity for the analysis of both navy and air force logistics, especially since the RAF became the

⁴⁴ Hone, Friedman and Mandeles, *American & British Carrier Development*, 69-70.

⁴⁵ Ballantine, *US Naval Logistics in the Second World War*, 169.

⁴⁶ Richard M. Leighton and Robert W. Coakley, *Global Logistics and Strategy 1940-1943* (Washington: Department of the Army, 1955), 212.

⁴⁷ For coverage of the Norwegian Campaign see Till, *Air Power and the Royal Navy*, 11-29.

⁴⁸ Ballantine, *U.S. Naval Logistics in the Second World War*, 3.

⁴⁹ Eccles, *Logistics in the National Defense*, 10.

senior air service at the end of the First World War and has remained so ever since. This link was more important for the Royal Navy than, for example, the USN, given the dual control of the FAA in the inter-war years. Even between 1939-1945 in the realms of aircraft production, maintenance, storage and distribution the Ministry of Aircraft Production and the RAF were key players in the navy's ability to field an effective force.

The major economic air requirements were ship building and aircraft production. Geographically these activities were widely dispersed, especially during the Second World War when the enormous resources of the United States, uninterrupted by dislocation of war, were brought to bear with great benefit for the entire Allied war effort: 'In 1943 the British Navy received...26 auxiliary aircraft carriers and 72 destroyer escorts and frigates... In addition there were numerous minesweepers, smaller anti-submarine vessels, tugs and landing craft...' ⁵¹ As Julian Thompson observed, it was an era when the only restriction on production was economic capacity:

'Technology had not yet progressed to the stage where equipment was so complex and expensive that cost was a limitation on the numbers that could be produced. The quantity of tanks, guns and aircraft that a nation could produce were a factor of the state of its industry, coupled with its access to raw materials.' ⁵²

The FAA benefited from the USA materially to the tune of thirty-eight CVEs, one Air Stores Issuing Ship, 6600 aircraft with spares and the training facilities for a large number of squadrons. The official history on the use of merchant shipping in the war noted that the need to undertake training overseas placed an additional burden on transportation resources:

'In this country, where space and safety were hard to find, it was impossible to train air-crews in sufficient numbers. They had to be sent to Canada and other Commonwealth countries, and later to the United States, and brought home when their training was finished. These instances... illustrate the demand for passenger accommodation that must arise when an empire scattered over four continents attempts to mobilise and co-ordinate its resources...' ⁵³

⁵⁰ Ballantine, *U.S. Naval Logistics in the Second World War*, 8.

⁵¹ Duncan H. Hall and C.C. Wrigley, *Studies of Overseas Supply* (London: HMSO, 1956), 36.

⁵² Thompson, *Lifeblood of War*, 101.

⁵³ C.B.A. Behrens, *Merchant Shipping And Demands Of War* (London: HMSO, 1955), 219.

However, the cost of aircraft spares alone supplied from the USA amounted to \$200 million. It is impossible to emphasise how different the FAA's wartime experience would have been without the support of the United States Navy.

This profligate production capability compared extremely favourably with the most controversial failure of Britain's economy for the FAA in the field of naval aircraft production. A combination of complex specifications, outdated designs, long development periods and small production capacity caused serious tensions between the navy and the Ministry of Aircraft Production, which co-ordinated the air requirements of the RAF and the FAA. At times there were no naval fighters in production in Britain and the reaction of aircrews upon receiving Royal Air Force cast-offs which had already been shot down in the Battle of Britain can only be imagined. In the First World War the RNAS was very much an integral part of the Senior Service and was able to take advantage of the navy's technological superiority and procurement organisation. Comparisons have been made with the neglect of merchant ship construction in the First World War in favour of warships and the neglect of naval aircraft in the Second; the official history on the *Administration of War Production* between 1939-1945 noted the simmering atmosphere within which naval aircraft production took place:

'...emotions engendered by the rough-handling of merchant ship-building in the first war had had twenty years to die down... whereas the controversy over naval aircraft had continued at fever heat. At least from that point of view, indeed, the closer parallel would seem to be the one... between the twentieth-century problem of naval aircraft and the nineteenth century one of naval ordnance.'⁵⁴

Air logistics and operations

The impossibility of producing a coherent strategy under enemy pressure in the early years of the Second World War meant that many operations were somewhat ad hoc rather than planned. Like the navy as a whole and many other elements of the British armed forces, units of the FAA were ordered into action at short notice. The small size of the FAA at the beginning of hostilities was exacerbated by the loss of *Courageous* and *Glorious*, two of the four major fleet units, and personnel were stretched to the limit on operations and squadrons stripped of experienced crew to man new training units as responsibilities were taken over from the RAF. Even in the case of the BPF in 1945 Ned

⁵⁴ J.D. Scott and Richard Hughes, *The Administration Of War Production* (London: HMSO, 1955), 157-158.

Willmott observed that aircraft losses had a greater impact than those of the Americans since the BPF's carrier groups constituted a higher proportion of the overall air establishment in the theatre than those of the USN.⁵⁵ In the early war years a high proportion of the overall strength was operating in the First Line squadrons. During the First World War the RNAS was not stretched operationally until 1917 when it was forced to expand a number of its key roles simultaneously.

Admiral Raymond Spruance who commanded the U.S. Fifth Fleet in the Pacific noted: 'If the necessary minimum of logistic support cannot be given to the combatant forces involved, the operation may fail, or at best be only partially successful.'⁵⁶ The British Admiralty Supply Representative in Washington defined what the operational commander required in logistic terms in July 1943:

'...all material preparations which are necessary to ensure the Commander can carry out his plan... includes repair, maintenance, docking, supply of weapons, protective devices, ammunition, materials, fuel, victualling, stores used by the Navy whether ashore or afloat & craft for service in the Fleet.'⁵⁷

The movement of logistic resources into theatre to carry out the strategic plan was naturally a prerequisite to successful sustained operations. The Americans became mobile in the Pacific through a combination of Service Squadrons afloat and shore bases swiftly brought into action by Construction Battalions: 'The coming of the fleet train and underway replenishment techniques from oilers and stores ships in the Second World War endowed navies with as great endurance as in Nelson's time; except that his ships could stay at sea for years, with longer intervals between dockyard maintenance periods than modern warships.'⁵⁸

The FAA depended upon merchant ships, flight delivery and later Escort Carriers (CVEs) operating in the ferry role to supply its aircraft around the world. Merchant ships carried crated aircraft but usually only in small numbers per ship and these required complex reassembly facilities at their destination. As the quantity of aircraft rose, especially from the United States, more CVEs were employed in this role provoking argument over the navy's priorities. It was not until the advent of the VSTOL jet and the

⁵⁵ Willmott, *Grave of a Dozen Schemes*, 141.

⁵⁶ Department of the Navy, *Naval Doctrine Publication 4: Naval Logistics* (Washington: Department of the Navy, 2001), 33.

⁵⁷ Memorandum by British Admiralty Supply Representative, USA, to Deputy First Sea Lord, 7 Jul 1943, ADM 1/13169.

⁵⁸ Thompson, *Lifeflood of War*, 17.

helicopter that the problem of transporting aircraft reinforcements and the use of specialist shipping, usually carriers, proved unnecessary.

In the post-war era, an excellent example of the mobility of naval power compared with the static nature of land-based air power was provided by HMS *Eagle*'s sixty day patrol off Beira at short notice in 1966. Ironically it occurred shortly after the cancellation of new carrier CVA-01 and the government's acceptance of the RAF's island base strategy in the Indian Ocean. The navy's superior agility was reported with obvious satisfaction by the Flag Officer Middle East:

'The cover of the approaches to Beira provided by aircraft from HMS *Eagle* was excellent throughout her long patrol. This, and the speed with which the operation was mounted, provided an excellent demonstration of the flexibility and effectiveness of naval air power. The delays and frustrations still being suffered by the Royal Air Force in obtaining clearance to fly from Majunga provided an alarming contrast, and give rise to sober reflection on the situation which will arise in the mid-1970s.'⁵⁹

It was in the operational theatre where the efforts of the production facilities, training bases and transportation system were brought together by operational units into coherent system: 'Strategy and tactics provide the scheme for the conduct of military operations; logistics provides the means therefore.'⁶⁰ The final hurdle to be surmounted was the maintenance of aircraft in serviceable condition on a day-to-day basis.

Air logistics and tactics

Tactically, the means of maintaining aircraft at their operational base, be afloat or ashore was the major requirement. As David Hobbs noted: 'Aircraft carriers are unusual warships in that they support weapons systems more technically complex than the ships themselves.'⁶¹ This is clear from the crew composition of the crew of one of today's Invincible class carriers, 366 personnel in the Carrier Air Group as opposed to a ship's company of 686. Aboard the American Nimitz Class carriers, 43% of the crew were devoted to air operations – a 2480 strong Air Group compared with a ship's crew of 3200 - demonstrating the economies of scale compared with the 34% of an Invincible. The majority of the air personnel are for maintenance rather than flying duties. The high level

⁵⁹ Report No.314/176/LEM/12 by Flag Officer Middle East, 6 Jun 1966, ADM 355/35.

⁶⁰ Eccles, *Logistics in the National Defense*, 19.

⁶¹ Hobbs, *Aircraft Carriers of the British and Commonwealth Navies*, 16.

of training required by maintenance personnel dates back to the First World War when in many cases they were much better qualified than pilots.

While the percentages of FAA aircrew in the inter-war period from the RN or RAF tend to be widely quoted, the fact that all of the maintenance personnel were from the RAF is largely forgotten and does not appear to have been a controversial issue. Thus while there was a lack of senior naval officers with air experience, there were very few at any level with air maintenance experience.

The differing environments presented various logistical challenges. Aboard ships in the Atlantic, Mediterranean, Arctic and Far East aircraft engaged in a multitude of operations including convoy escort, combat air patrols, anti-submarine, ship strike and reconnaissance. Bases in the United Kingdom, Canada, the United States, the Middle East and Far East afforded facilities for aircrew training, working up, disembarked squadrons and operational sorties. FAA squadrons assumed Coastal Command duties in the waters around Britain and flew from numerous airfields in the Mediterranean. It is interesting to analyse how the maintenance crews coped in a multitude of largely inhospitable conditions.

Conclusion

This chapter has highlighted the significance of logistics in military affairs, how the different levels of logistic provision are inter-related and the unique requirements of air logistics compared with those for the rest of the Senior Service. The rest of this study aims to study the growth of two organisations – the RNAS and FAA – under wartime conditions in the fields of planning, procurement, co-ordination of resources and maintenance. Through the focus upon logistics a new interpretation should emerge of the history of British naval air power, complementary to those authors who have analysed operations, but failed to explore the logistic background.

Chapter 2 – Strategy and Naval Air Requirements

Overview

The aim of this chapter is to outline the major strategic decisions which influenced the expansion of British naval aviation during both World Wars and the naval air expansion programmes that resulted. Future chapters will examine how successfully these expansion plans were met in the spheres of air bases and aircraft production. Both air forces had to expand from a small base at outbreak of war that was more significant for the FAA, given the greater importance of naval aviation in 1939.

The expansion programmes differed in a number of ways. In 1939 the growth of the FAA was largely pre-determined. Planning for naval air expansion had proceeded throughout the 1930's with orders for the Illustrious Class carriers, which defined pre-war naval air policy, beginning in 1936. The requirement for trade protection, the major addition to FAA strength during the Second World War was appreciated, but resources were not sufficient to build ships for work in fleet and trade roles. A four year aircraft expansion programme was drawn up in 1938 and one of a similar time span in 1942, with their major facets, the carriers and aircraft being familiar entities.

This was hardly possible for the RNAS and no overall establishment for the organisation was laid down until 1916; given the changing operational tasks and rapid technological changes in engines, airframes and weaponry any pre-war plans would have been rendered swiftly obsolete. Technological developments resulted in large numbers of aircraft types. In fact the long-term plans in the Second World War, perhaps unsurprisingly, proved highly susceptible to fluctuating wartime conditions and the vagaries of production capacity. The largest increase in FAA strength came from America, a source of production that could not have been foreseen. Indeed the American contribution enabled the FAA to attain a size that could not otherwise have been achieved and was unsustainable without continued US support.

However since the demarcation line between the duties of the RNAS and RFC had not been clearly defined and with aviation in its infancy, the RNAS was able to proceed with an almost uncontrolled expansion making use of the Navy's long standing links with industry to produce the most effective aircraft. This contrasted with the FAA's strictly defined role and limited manufacturing capacity controlled by the Ministry of Aircraft Production from 1940 and dominated by the RAF. During the First World War the majority of naval air power was land-based as opposed to carrier-based forces between 1939-1945 when the number of carriers largely dictated air requirements. Secondly, there was a

marked contrast between the use of aeroplanes, seaplanes, airships and kite balloons in the Great War and the concentration on wheeled aeroplanes from the 1920s. Expansion programmes for aircraft in the First World War largely encompassed aeroplanes, seaplanes and their engines, the production facilities for airships and kite balloons being separate.

The complexity of aircraft in the 1940s meant the FAA had to operate with types under consideration at the beginning of hostilities or those adapted from RAF designs. The RNAS operated a rapidly developing array of aircraft and airships with much shorter design periods. In the First World War the design and performance of naval aircraft was similar to that for RFC aircraft, in many cases because they used the same types, the RNAS being as much engaged in shore-based tasks as purely naval ones. With aviation in its infancy between 1914-1918 the RNAS also engaged in the whole spectrum of air operations and much more besides with an anti-aircraft corps,¹ armoured cars,² and even armoured trains.³ Strategic decisions, either governmental or naval, contributed to expansion plans, either in size or types of forces required. Several factors influenced the changes of expansion plans including requirements of national strategy, operational naval experience, and improvements in technology and production capacity.

RNAS strategy and naval air requirements

Naval air expansion programmes

The sources for the RNAS do not allow such a systematic examination of the naval aircraft expansion programmes as that for the FAA in the Second World War. It is especially difficult to determine the target date for many programmes in the early years of the war to judge their success. This can partially be explained by the difficulty of laying down large-scale programmes given the new nature of the material, relatively unknown manufacturing capacities and rapidly changing technological background. The First Lord's fortnightly returns for the RNAS detailing the aircraft in commission, anticipated deliveries for the next two weeks and the remaining orders for each type began on 15 February 1916.⁴ The Admiralty Intelligence Division's Quarterly Returns for War Vessels and Aircraft listing the aircraft in commission and on order did not start until July 1916.⁵ It is also problematic because many aircraft and airships were allocated to air stations with no specified establishment and there was no official size for squadrons until 1916. Unlike in the Second

¹ Report on Anti-aircraft Section of Air Department, 1915, ADM 1/8418/100.

² Armoured car force of RNAS, 1915, ADM 1/8418/99.

³ Reports on operations of armed trains, 1914-1915, AIR 1/2099/207/20/7.

⁴ First Lord's RNAS fortnightly returns, 15 Feb 1916 – 31 Dec 1917, AIR 1/150/15/113/1-3.

⁵ Naval Intelligence Division, Admiralty, *War Vessels and Aircraft (British and Foreign) Quarterly Returns*, Jul 1916 – Apr 1918, NHB.

World War there was no defining gauge for expansion. The number of carriers dictated much of the rest of the programme between 1937-1945.

The aircraft programme in December 1914 highlighted the orders since the outbreak of war; 300 aeroplanes, 96 seaplanes, 8 special seaplanes and 14 Atlantic seaplanes plus the seaplane carrier *Campania*.⁶ As early as April 1915 Churchill, the First Lord, made the first pronouncement on large scale aircraft requirements: 'Every effort should be made to reach 1,000 aeroplanes and 300 seaplanes as early as possible before the end of the present year. 400 pilots will be required, and all arrangements should be made to procure and train them.'⁷ However this was never a realistic proposition as Rear-Admiral Vaughan-Lee, Director of Air Services (DAS), noted a year later:

'No definite scheme of allocation for Aeroplanes and Seaplanes at home and abroad has existed up to now. The only scheme worked to has been that of the late First Lord, who decided that the Establishment of the Royal Naval Air Service should be 1,000 Aeroplanes and 300 Seaplanes. This Establishment has long been recognised as being unworkable.'⁸

Between July 1916 - April 1917, when detailed figures are available from the Intelligence Division's Quarterly Returns, the number of aeroplanes in commission and on order comfortably exceeded the corresponding figures for seaplanes. In April 1917 there were 1403 aeroplanes in all roles and 1256 on order with only 393 and 759 seaplanes respectively. The quantity of 'seaplanes' on order rose dramatically to 1221 in July 1917 and 1440 in April 1918 when the number of seaplanes in service had also more than doubled to 823. However much of the latter increase, 215, was due to the introduction of wheeled fighters and reconnaissance aircraft on capital ships, which were counted as seaplanes, that term being given to aircraft operating in close proximity to the fleet, rather than simply aircraft with floats.⁹

One of the few documents to give a comprehensive long-term summary is a minute simply signed 'Wing Commander RN' dated 27 February 1917. It details the anticipated and actual deliveries between June 1916 and January 1917:

⁶ Extracts from Admiralty Memorandum for Cabinet, 9 Dec 1914, Doc. No.57, in S.W.Roskill, ed, *Documents Relating to the Naval Service, Volume I 1908-1918* (London: Navy Records Society, 1969), 185-186.

⁷ Minute to War Council by Mr Churchill, First Lord, 3 Apr 1915, Doc. No.65, in Roskill, *Documents Relating*, 200-201.

⁸ Minute by DAS, 15 Mar 1916, ADM 1/8449/39A.

Table 1. Anticipated and actual deliveries of aircraft and engines, June 1916 – January 1917¹⁰

Period	Engines			Aeroplanes		Seaplanes	
	Anticipated deliveries	Deliveries Ex Army	Deliveries Ex-Admiralty contracts	Anticipated deliveries	Deliveries Ex Admiralty contracts	Anticipated deliveries	Deliveries Ex Admiralty contracts
1916	197	13	141	113	121	65	41
Jun							
Jul	356	14	272	109	129	44	41
Aug	319	15	232	119	149	42	48
Sep	349	21	188	135	111	48	14
Oct	294	2	182	135	107	47	14
Nov	381	10	244	148	115	56	17
Dec	544	5	301	152	113	41	18
1917	395		415	136	149	33	11
Jan							
Total	2835	80	1975 (-780)	1047	994 (-53)	376	204 (-172)

This shows that while aeroplane production was only 5% short of orders, seaplane production was 46% short and engine production 31% less than specified. Between February - July 1917 aircraft deliveries for the RNAS's training requirements alone totalled 90 aeroplanes per month comprising five Maurice Farman Shorthorns, twenty Maurice Farman Longhorns, thirty Avro Type 179s, twenty BE2Cs or 2Es and fifteen Sopwith Pups. A possible increase of twenty-five per cent was earmarked for July 1917.¹¹

There was pressure for more accurate aircraft estimates in 1917 as production for both the RFC and RNAS was co-ordinated by the Ministry of Munitions and therefore had to be thoroughly justified for the allocation of resources. For example it was calculated that for seaplane bases in Channel¹² to maintain three patrols a day with two aircraft each would need eighteen aircraft to guarantee availability: 'This represents 396 seaplanes in commission in the Channel; assuming the life of a seaplane as averaging four months in the Channel, this would require 1,188 seaplanes by the end of the year.'¹³ The Director of Air Equipment estimated on 5 February 1917 between 1500 and 2000 machines were required

⁹ Naval Intelligence Division, *Quarterly Returns*, Jul 1916 – Apr 1918, NHB.

¹⁰ Minute by Wing Commander RN, 27 Feb 1917, AIR 1/149/15/93.

¹¹ Letter from DAS to Secretary of the Air Board, 15 Feb 1917, AIR 1/149/15/93.

¹² Newlyn, Scillies, Mullion, Cattewater, Queenstown, Portland, Bembridge, Calshot, Cherbourg and Brest.

and recommended the immediate orders for 1000 anti-submarine aircraft including 200 Large Americas, 400 seaplanes of either 310hp Sunbeam Shorts or 250hp Fairey Campanias and 400 aeroplanes of two-seater Sopwith two-seaters.¹⁴ Quarterly requirements for new seaplanes for the Channel Patrol would rise from fifty-two in April 1917 to 120 in June, 174 in September and 240 in December.¹⁵ To give an idea of the size of requisitions for aircraft and engines, prior to formal ordering, for the week ending 23 June 1917, fourteen requisitions were placed totalling 2506 aeroplanes, 125 engines, twenty-six flying boats and six seaplanes.¹⁶

Pre-war planning

Pre-war planning centred on a chain of air stations along the East Coast of England for coastal patrolling and support of the Fleet.¹⁷ As the main requirement to equip these stations was for seaplanes Churchill stated at the 121st meeting of the Committee of Imperial Defence in January 1913 that the navy's priority would be the development such aircraft.¹⁸ Accordingly he informed the Second Sea Lord in September 1913 of the number of machines required: 'If we aim at a war establishment of 100 machines, we should apparently require at least 150 or 160 to realise this. It is not necessary, however, to reach it in the first or second year.'¹⁹ The second annual report of the Air Committee in May 1914 noted the change in emphasis in the types of aircraft in the last twelve months; in May 1913 there were twenty-eight aeroplanes with sixteen on order compared with only six seaplanes commissioned and thirty-three ordered. By 1914 seaplanes were in the majority with fifty-five in service and forty-five on order compared with only forty and four respectively for aeroplanes.²⁰

Aviation and the Grand Fleet

Support for the fleet was an obvious role for naval aviation but was limited as seaplanes could not take off or land on anything but the calm seas. Admiral Jellicoe, Commander-in-Chief of the Grand Fleet wrote to Beatty on 7 August 1915 that for seaplanes: '...the chances are about a hundred to one against it being suitable for them to

¹³ Draft paper 'Aircraft requirements 1917' by DAS, 12 Feb 1917, AIR 1/149/15/93.

¹⁴ Minute by DAE, 5 Feb 1917, AIR 1/149/15/93.

¹⁵ Minute by DAS, 12 Feb 1917, AIR 1/149/15/93.

¹⁶ Sixteenth report by Department of Aeronautical Supplies, 23 Jun 1917, AIR 1/151/15/118.

¹⁷ Extracts from Memorandum by D.A.D., Aug 1913, Doc. No.33, in Roskill, *Documents Relating*, 109.

¹⁸ Extracts from Minutes of 121st CID meeting, 7 Jan 1913, Doc. No.25, in Roskill, *Documents Relating*, 72.

¹⁹ Minute by First Lord to Second Sea Lord, 27 Sep 1913, Doc. No.36, in Roskill, *Documents Relating*, 115.

²⁰ Extracts from Second Annual Report by Air Committee on RFC, 9 May 1914, Doc. No.41, in Roskill, *Documents Relating*, 129.

rise from the water.’²¹ The Grand Fleet’s first seaplane carrier, HMS *Campania*, a converted Cunard liner, did not arrive until April 1915 and HMS *Manxman*, added in 1916, proved to be wholly inadequate: ‘The recently joined seaplane carrier “Manxman” has proved to be totally unfit for service with the Battle-Cruiser Fleet owing to her lack of speed.’²² The turning point proved to be the failure at the Battle of Jutland on 31 May 1916, when *Campania* was ordered back to Scapa Flow and *Engadine*, operating with Beatty’s battlecruiser force managed only one reconnaissance flight.²³ HMS *Argus*, the RN’s first flush deck carrier was ordered in September 1916 and a month later Jellicoe’s requests for kite balloons was finally accepted by the Admiralty.²⁴ At a meeting between Jellicoe and Rear Admiral Tudor, the Third Sea Lord, in October 1916 the former rejected a suggestion that flying boats could replace seaplanes

‘...the radius of action of flying boats is insufficient to enable them to work with the Fleet and that the difficulties of re-fuelling them at sea, even if they safely make the rendezvous ordered, are great. H.M. Ships “Campania” and “Engadine” therefore remain the only means of aerial scouting that the Fleet can expect, except kite balloon inflated on shore and towed by battleships.’²⁵

In October 1916 there were only fifty ‘Class 1’ seaplanes allocated to carriers of the Grand Fleet out of a total of 408 in service.²⁶ Fleet aviation took a relatively low priority in 1916 in comparison to that for strategic bombing.

Admiral Jellicoe was convinced of the advantage afforded to the High Sea Fleet through its possession of Zeppelins for reconnaissance. However, the expansion programme for British rigids followed a distinctly slow and uncertain path. No.9, the first rigid after the ill-fated *Mayfly*, was ordered from Vickers in March 1914, but work was stopped in February 1915 only to be restarted five months later. In October 1915 three of the 23 Class were ordered from Armstrong, Beardmore and Vickers with five more following in January 1916. One month later two wooden rigids were approved from Shorts and a rigid programme totalling eleven airships was approved in June 1916.²⁷

²¹ Arthur Marder, *From Dreadnought to Scapa Flow, Vol IV: 1917 Year of Crisis* (Oxford, Oxford University Press, 1969), 11.

²² Letter from C-in-C Grand Fleet to Secretary of the Admiralty, 11 Jan 1917. AIR 1/651/17/122/447.

²³ Friedman, *British Carrier Aviation*, 47.

²⁴ Minute by DAS, 25 Nov 1916, AIR 1/651/17/122/447.

²⁵ Extract of minutes from meeting between C-in-C Grand Fleet and Third Sea Lord, 12 Oct 1916. AIR 1/651/17/122/447.

²⁶ First Lord’s RNAS fortnightly return, 1-15 Oct 1916, AIR 1/150/15/113/3.

²⁷ Paper ‘Present situation in airship operations and construction’, Jun 1916, ADM 1/148/15/80.

In lieu of rigid airships, which were delayed by slow construction, six twin-engined North Sea type non-rigids were ordered for fleet use in March 1916.²⁸ A further six were ordered in November 1917 to keep six in commission and replacements procured for the six lost in 1918.

At the beginning of 1917, Admiral David Beatty, new C-in-C of the Grand Fleet, observed the inadequate air support for the Fleet and requested improvements in the use of seaplane carriers, kite balloons, rigid airships and large seaplanes. Godfrey Paine, the Fifth Sea Lord, ordered that twenty-five per cent of pilots should be utilised for fleet work. To reinforce his air capabilities before the completion of *Argus* Beatty forced through the conversion of HMS *Furious* to carry aeroplanes in March, together with merchant ships *Pegasus* and *Nairana* as seaplane carriers. The world's first purpose-built carrier, HMS *Hermes*, was laid down in July 1917. Jellicoe's intervention had led to the a large order of sixty of kite balloons and twenty-four meteorological balloons for Fleet and patrol work.²⁹ To increase the number of fighters available the anti-Zeppelin role experiments were undertaken to them fighters from the platforms on cruisers, the first successful flight by Flight Commander F.J. Rutland from HMS *Yarmouth* in June 1917. Turret platforms were developed shortly afterwards enabling the use of aeroplanes from capital ships.³⁰

In addition to providing the fleet with fighter cover and a reconnaissance capability, planning was well advanced by the end of the war for an offensive torpedo-bomber capability. A plan submitted by Squadron Commander de G. Ireland, CO at Great Yarmouth in 1916 for between 100-150 torpedo-carrying seaplanes was afforded a low priority by the Admiralty. There were problems developing a seaplane, which could carry an eighteen-inch torpedo, yet this failure can only be seen as a product of the tactical thinking within the Admiralty. The torpedo-carrying seaplane had been technically proven in the Dardanelles in 1915 and the Admiralty had developed the large Handley Page bomber from scratch without a precedent. Indeed it was the formation of an offensive capability at Luxeuil in northern France in 1916, which pre-occupied Vaughan-Lee, the Director of Air Services, and other senior figures within the Admiralty. It was not until February 1917 that twenty-five Short 320 seaplanes capable of dropping an eighteen-inch torpedo were ordered for use in the Adriatic. To equip HMS *Argus* and other ships in the Grand Fleet 200 Sopwith Cuckoo torpedo-carrying aeroplanes were ordered 1917.³¹

²⁸ Minutes of conference held by SAC, 4 Mar 1916, AIR 1/148/15/80.

²⁹ Minute by DASD, 18 Jul 1917, AIR 1/669/17/122/782.

³⁰ Friedman, *British Carrier Aviation*, 54.

³¹ Letter from Secretary of Admiralty to Secretary to Air Ministry, 8 Aug 1918. ADM 1/643/17/122/257.

Air defence of Great Britain

With the despatch of the whole RFC to France, responsibility for the air defence of the UK was transferred to the RNAS on 3 September 1914. This decision had two long-term ramifications for the RNAS; firstly, to have any hope of engaging the Zeppelins high performance single-seater fighters were required and secondly, the inability of existing aircraft to engage the Zeppelins at high altitude saw the Navy adopt an offensive strategy against Zeppelin bases, one of the stimuli for its strategic bombing policy. Any bases or manufacturing facilities in Germany, which supported their naval forces, were regarded as legitimate targets and the first attack on Zeppelin sheds in Germany took place on 22 September with aircraft based in Belgium. On 28 December 1914 Murray Sueter, Director of the Naval Air Division, drew up the specification for a 'bloody paralysing' of an aircraft to pursue the offensive policy, which manifested itself as the twin-engined Handley Page. Indeed in April 1915 Churchill stressed: '...the necessity of developing a very large fleet of aircraft, capable of delivering a sustained series of "smashing blows" on the enemy; more in the nature of "bombardment" by ships than the present isolated "dashing exploits" of individual or two or three aeroplanes....'³² This offensive posture was also apparent with the requisitioning of three seaplane carriers *Empress*, *Engadine* and *Riveria* in August 1914 to launch torpedo attack on High Seas Fleet; however the problems of designing a seaplane with sufficient engine capacity to carry an adequate sized torpedo saw them being used to bomb the Zeppelin sheds at Cuxhaven on 25 December 1914.

Aeroplanes were based at coastal stations in the hope that they could intercept Zeppelins before or after their attacks. Air defence requirements also led to the formation of Anti-Aircraft Section of the Air Department which by April 1915 comprised 42 officers and 1052 men.³³ The RFC took over defence of Great Britain in early 1916, but home defence remained a secondary role for the RNAS; its aeroplanes in Britain in 1916 became mainly second-class types and were utilised on night flying training.

The embarrassment suffered by the RNAS when it was unable to intercept Zeppelins in 1915 was nothing compared with the furore, which occurred when twin-engined Gotha bombers raided London in the summer of 1917. Such was the impact of these attacks that the government afforded aircraft production priority over all other munitions. The policy of strategic bombing was now given official government backing with forty new squadrons allocated for bombing of German cities. The headline figures were certainly impressive with a planned increase of RFC squadrons from 108 to 200 and a

³² Minutes of conference held by First Lord, 3 Apr 1915, ADM 1/8433/270B.

³³ Report on Air-Aircraft Section of Air Department, 20 Apr 1915, ADM 1/8418/100.

trebling of the monthly engine output from 1200 to 4500 with a comparative, but unspecified expansion for the RNAS.³⁴ At the end of July 1917 several hundred DH4s and 100 Handley Pages were ordered, increased on 6 September to 2700 DH4s and DH9s and 300 Handley Pages. The big problem was meeting such production targets and this will be addressed in the next chapter.

The continental commitment and strategic bombing

Churchill's decision to deploy Royal Marines to defend Antwerp in August 1914 led indirectly to the largest RNAS commitment of the whole war; Samson's Eastchurch Squadron accompanied the Marines to provide reconnaissance so beginning a continental commitment which was to last until the end of the war. As early seaplanes were found to be relatively ineffective and airships were identified in 1915 as the preferable platform for the anti-submarine role, the base at Dunkirk provided an outlet for the Navy's substantial aircraft production capacity which could not be employed on naval duties. In addition to patrolling the Channel, the Admiralty justified the existence of a continental force from an early stage as a contribution to the air defence of Britain, for which Dunkirk would be the first line of defence. When Samson's squadron retreated to Dunkirk attacks were also undertaken on Zeppelin bases which the Germans established in Belgium much to Churchill's approval: 'We would have to concentrate our energies on the Belgian coast, and make every effort to attack Zeppelin bases in case they opened some in Belgium.'³⁵ On 21 June 1915 approval was given for an increased establishment at Dunkirk of six squadrons, in addition to the two at Dover.

However, the Admiralty wanted another outlet through which it could expand its offensive strategy. It is noticeable that in a paper by Rear-Admiral Vaughan-Lee, Director of Air Services, on 28 February 1916 the first priority of the RNAS is not to support the fleet or engage in anti-submarine duties, but: 'To attack the enemy's fleets, dockyards, arsenals, factories, air sheds, &c., from the *coasts*, whether the coasts be the enemy's or own (i.e. long distance bombing).'36 The Admiralty's unilateral decision to prosecute long distance bombing alongside the French saw the first deployment of personnel to Luxeuil northern France in May 1916. Initially the deployment was hampered by the diversion of resources to the RFC in preparation of the Somme offensive. The Luxeuil deployment

³⁴ Development of aircraft production, 1917-1918, AIR 1/678/21/13/2138.

³⁵ S.F. Wise, *Canadian Airmen and the First World War: The Official History of the Royal Canadian Air Force, Volume I*. (Toronto: University of Toronto Press, 1980), 132.

³⁶ Extracts from Joint War Air Committee, Extracts from Paper Air 4, 3 Mar 1916, Doc. No.106, in Roskill, *Documents Relating*, 310.

caused outrage in the ranks of the Army and the RFC who were appealing for more resources for the Battle of the Somme. The full extent of the deployment was laid bare by Colonel Bares, the RNAS's French liaison officer, in a visit to London in October 1916 which caused the following reaction from Field Marshal Haig:

‘...the employment of bombing machines in France is, I contend, primarily even if not entirely, a military question... unless my requirements have first been adequately provided, the provision of flying machines by the naval authorities for work on the fronts of the French or Belgian armies in France amounts to very serious interference with the British Land Forces, and may compromise the success of my operations.’³⁷

Under pressure the result was inevitable and the first RNAS squadron was transferred to support the RFC on the Western Front in the autumn of 1916. The enthusiasm of the RNAS to engage in land-based roles left it open to having its aircraft purloined by the RFC, especially as there was little difference in the performance of their aircraft.

In January 1918 the Air Council placed seven Dunkirk squadrons under the command Commander-in-Chief BEF, for operations on the Western Front and the naval element at Dunkirk was reduced to a reconnaissance squadron, an anti-submarine squadron equipped with DH4s and three Sopwith Camel fighter squadrons.³⁸

Anti-submarine warfare

The RNAS's responsibility for patrolling the North Sea and the Channel was soon to take on a much more focussed role, that of anti-submarine patrols. A succession of high profile losses including the elderly armoured cruisers *Aboukir*, *Hogue* and *Cressy* which were sunk in rapid succession by U9 in September 1914 and the sinking of the pre-dreadnought *Formidable* in early 1915 forced the Admiralty to take action as Midshipmen Victor Goddard, one of the first airship pilots, noted: ‘When the submarine menace began to be important in the naval mind, the political field... Lord Fisher decided as First Sea Lord – to develop the airship and use it as a submarine searcher...’³⁹

The non-rigid airship possessed three key advantages; first it was not hampered by sea states, which were crucial to seaplanes for taking off and landing, second it had a much

³⁷ Letter from C-in-C BEF to Secretary of the War Office, 1 Nov 1916, ADM 1/8449/39A.

³⁸ Letter from Secretary of Air Council to Secretary of War Office, 22 Feb 1918, ADM 1/8500.

³⁹ Victor Goddard, Imperial War Museum/Sound Archive 303, 38 [Further references to Imperial War Museum/Sound Archive will be referred to as IWM/SA].

longer endurance and third it was much easier to produce than larger rigids of the Zeppelin type. Admiral Fisher, the First Sea Lord, called a meeting on 28 February 1915 to discuss the requirement for a non-rigid airship which should be of simple design, with a crew of two, carry 160lb of bombs and have an endurance of eight hours.⁴⁰ Such swift progress was made on the design and development that the first prototype of the Submarine Scout (SS) airship flew at the end of March and twenty-seven were soon ordered.⁴¹ Rapid progress was made on expanding the airship programme and at a conference held by the First Sea Lord on 19 June recognised the need for a larger non-rigid with greater range, reliability and speed capable of scouting up to 150 miles from the coast and Churchill sanctioned the order for thirty of the Coastal Class.⁴²

At a conference held by the Superintendent of Aircraft Construction (SAC) on 4 March 1916 forty improved SS airships, the SS Pusher (SSP) type were ordered together with one C Star, a development of the somewhat disappointing Coastals.⁴³ The C Star with a new envelope was superior to the Coastal in all aspects except rate of climb, but mechanical problems delayed its entry into service; at the height of the programme twenty were envisaged, but this was later reduced to ten. The first was not completed until January 1918 with the remainder in service by September.

Due to production difficulties the SSP did not appear until January 1917 and only six were completed by May 1917 when the programme was terminated in favour of the SS Zero, which had a much superior boat shaped car. Sixteen Zeros were ordered on 6 April 1917 and at one time ninety-three were specified in the expansion programme, but by November 1918 it was planned to keep fifty-nine in commission. The main reason for this reduction was the design of the superior twin-engined SS ship proposed in 1917; trials of S.S.E.1 in early 1918 were unsatisfactory but S.S.E.2 known as the 'Mullion Twin' since it was designed at Mullion air station in Cornwall met all requirements and the production of twelve SS Twins was approved. In November 1918 the envisaged operational airship strength was eleven rigids, fifty-nine SS Zeros, 115 SS Twins, ten Coastals and ten North Sea airships.

Flying boats and aeroplanes increasingly supplemented the airships and seaplanes available for anti-submarine patrols in 1917-1918. The impetus for improvements in anti-submarine forces came first with the creation of Anti-Submarine Division in December 1916 and then Germany's unrestricted submarine offensive, which began on 1 February

⁴⁰ Patrick Abbott, *The British Airship at War, 1914-1918* (Lavenham: Terence Dalton, 1989), 22.

⁴¹ Minute by DAD, 9 Jun 1915, AIR 1/148/15/80.

⁴² Minutes of conference held by First Sea Lord, 19 Jun 1915, AIR 1/2634.

⁴³ Minutes of conference held by SAC, 4 Mar 1916, AIR 1/148/15/80.

1917. In the early spring of 1917, 176 'Class I' seaplanes and forty-six airships were allocated for anti-submarine warfare. Large flying boats, which would revolutionise anti-submarine patrols came into service in early 1917; on 30 January 1917 the Director of Air Services reported the two Porte flying boats were in commission with eleven on order at a rate of delivery of one per week and five Large Americas had been commissioned, a further four were under construction and seventy-two on order with three to be delivered every fortnight.⁴⁴

Mediterranean operations, 1915-1918

Operations in the Mediterranean involved all types of naval air power, although on a small scale and the theatre was generally seen as secondary for the supply of new equipment. The Dardanelles campaign was the basis for a RNAS presence when to provide air reconnaissance and spotting capabilities the Admiralty deployed the seaplane carrier HMS *Ark Royal*, the aeroplanes of Samson's No.3 Wing which had seen action in France and Belgium and the kite balloon ship HMS *Menelaus*. However, Colonel Sykes, RFC, who reported on RNAS requirements in the Dardanelles in July 1915, found that the current air establishment wholly inadequate:

'A moderate measure of success has been obtained and valuable experience has been gained. But the scale of the land operations is now being largely increased and the necessity for extensive aeroplane reconnaissance and systematic co-operation is becoming more and more evident... To cope with this work a larger number of aeroplanes of a standard type will be required.'⁴⁵

As a result Samson was reinforced by No.2 Wing later in 1915 and two SS airships were allocated for use in the Mediterranean. The withdrawal from Gallipoli at the beginning of 1916 did not end the RNAS's commitment in the theatre where it performed reconnaissance and spotting roles for the Allied expeditionary force that landed at Salonika in October 1915. In March 1916 the Admiralty assumed responsibility for patrolling the Aegean and the routes from Malta and Salonika. By the spring of 1917 the majority of the aeroplanes of No.2 Wing were operating on the Salonika front and against targets in Turkey while the seaplanes operating from Thasos, Mudros and Suda Bay in Crete together with

⁴⁴ Minute by DAS, 30 Jan 1917, AIR 1/658/17/122/594.

⁴⁵ Report from Colonel F.H. Sykes to GHQ, British Expeditionary Force, Mediterranean, 9 Jul 1915, AIR 1/625/17/12.

airships at Kassandra and Mudros carried out anti-submarine patrols.⁴⁶ Murray Sueter, the first Director of the Air Division whom the Admiralty wished to relegate to a backwater on account of his radical views was given command of No.6 Wing in the Adriatic. Samson, another pioneer, was placed in command of the seaplanes carriers *Ben-my-Chree*, *Empress*, *Anne* and *Raven II* which operated in an army cooperation role off Palestine until November 1917.

When the RAF assumed control in April 1918 the Mediterranean command were split into five groups. The Adriatic Group patrolled the Otranto barrage and bombed U-boat bases at Cattaro and Durazzo. The Aegean Group was responsible to support the blockade of the Dardanelles, conduct U-boat patrols, support army at Salonika and bomb Turkish communications, air bases even Constantinople. The more minor Malta, Gibraltar and Egypt Groups undertook U-boat and convoy patrols in support of the introduction of Mediterranean convoy system.⁴⁷

The Carrier comes of Age

Fleet Carriers – backbone of the Fleet Air Arm

When Thomas Inskip, Minister of Coordination of Defence, proposed the return of the FAA to naval control in July 1937, he also recommended that the number of aircraft carriers should dictate the numbers of squadrons and therefore the aircraft, personnel and bases required: 'So far as numbers are concerned, these will be restricted by the capacity of the carriers and capital ships. I assume that the number of carriers will be regulated by Cabinet decisions.'⁴⁸ The expansion programme of the late 1930s was centred on the ordering of armoured carriers. The two factors which dominated Admiralty thinking were the flexibility to operate in both the Fleet Carrier and trade protection roles and the necessity of armoured protection. These ruled out the possibility of a 14,500-ton unarmoured ship with fifteen aircraft and set the minimum standard at an armoured carrier of 17,600 tons capable of operating twenty-four planes. The Fleet Carrier option was for a 23,000-ton ship to operate thirty-six aircraft.⁴⁹ Admiral Henderson, the Controller, concluded that the only type required was the 23,000-ton ship, the smaller carrier lacking the capacity for enough reconnaissance and strike aircraft in the fleet role. It was decided in June 1936 that for the foreseeable future all new vessels should be large Fleet Carriers (CVs) with older vessels relegated to trade protection:

⁴⁶ Report from VA, EMS to Secretary of Admiralty, 18 Apr 1917, AIR 1/649/17/122/408.

⁴⁷ Report from C-in-C Mediterranean to Secretary of Admiralty, 8 Sep 1918, AIR 1/649/17/122/409.

⁴⁸ Memorandum by Minister of Coordination of Defence, 21 Jul 1937, CAB 21/526.

⁴⁹ Notes of meeting held on 28 Apr 1936, ADM 1/1971.

‘...we must return to the policy of confiding trade protection to vessels not up to the standard of the Main Fleet, and as our strength grows in new carriers, older carriers will be available for trade route work. We will have to be content with that until we are up to strength in the large carriers, and then, and then only can we afford to give consideration to building a smaller carrier.’⁵⁰

Six armoured Fleet Carriers were laid down between 1937-1939 and formed the backbone of the FAA’s wartime strength.

A plan for FAA expansion was drawn up in April 1937 in a paper entitled ‘A New Standard of Naval Strength’. This envisaged fifteen carriers by 1942; four in Home Waters, four in the Mediterranean, which could be redeployed to the Far East to maintain a defensive strategy against the Japanese, and five on trade routes plus a deck landing training ship. There were to 450 aircraft which included those on capital ships and cruisers.⁵¹ At the outbreak of war the projected expansion for 1942 totalled 490 aircraft comprising eleven carriers and 360 aircraft, a seaplane carrier with nine aircraft, 101 aircraft embarked on battleships and cruisers and supernumerary, or reserve squadrons with 20 aircraft.

Initial wartime experience indicated that more carriers were needed for trade defence and Captain Charles Daniel, the Director of Plans, stated in January 1940 that the ships would be split 50:50 between fleet and convoy duties.⁵² However the loss of *Courageous* and *Glorious* and the failure to include a carrier in the 1940 construction programme meant that by the end of the year the fleet carrier programme was already two years behind schedule.⁵³

The Battle of the Atlantic takes centre stage

In 1941 the FAA began to address the need for specialist ships for trade protection and reserve aircraft formations. By 1 April, 106 additional aircraft were added to the programme, the majority, seventy-nine for supernumerary squadrons but also six for HMS *Audacity*, the first Escort Carrier (CVE). Supernumerary squadrons, later entitled Alternative Armament squadrons, were effectively reserve formations; requirements had been identified to allow carriers to be equipped with either single-seater or two-seater fighters, relieve tired personnel and allow first line squadrons to be withdrawn for further

⁵⁰ Minute by DCNS, 15 Jun 1936, ADM 1/11971.

⁵¹ Memorandum by First Lord to Defence Plans (Policy) Sub-Committee, CID, 29 Apr 1937, 11-12. CAB 16/182.

⁵² Minute by D of P, 24 Jan 1940, ADM 1/11971.

⁵³ Minute by D of P, 1 Dec 1940, ADM 1/11971.

training. *Audacity's* initial success plus mounting losses in the Battle of the Atlantic saw agreement in principle that all North Atlantic convoys would be escorted by a CVE. In the interim fighter catapult ships were employed for stopgap defence. By 1 July 1941 150 aircraft were added for another twelve CVEs. The majority of these and their aircraft would be supplied by the United States under lend lease; US production and training facilities underpinned the entire CVE effort and it was accepted from the start by the Admiralty that American aircraft were necessary to equip them. Admiral Lyster, Fifth Sea Lord, was concerned about the aircraft situation when he wrote to Alexander, the First Lord on 10 July 1941:

'The whole question of production of aircraft for the Navy depends essentially upon staff requirements based on the programme of ship construction. Up to the present no departure has been made from the pre-war principle that squadrons should be formed to arm all aircraft carriers and catapult ships to the full... if the production requirements of the Navy are not complied with the time would come when there would be carriers and other ships available with no aircraft to arm them.'⁵⁴

Lyster was especially anxious given the increased requirements envisaged by June 1943 involving thirteen CVEs equipped with 156 aircraft, and seven supernumerary squadrons requiring eighty-four planes. Lyster concluded that American help would be needed to meet the CVE requirements alone and further production was necessary for the supernumerary squadrons.⁵⁵ The Naval Air Expansion Programme of 30 September 1941 issued a revised target for mid-1943 of 925 first line aircraft up from 779. The lions share of the increase being 141 aircraft for further supernumerary squadrons.⁵⁶ By the end 1941 the programme included aircraft for twenty-two CVEs and was underway planning for Merchant Aircraft Carriers (MACs).⁵⁷

Reinforcing the Fleet

Following the loss of the capital ships *Prince of Wales* and *Repulse* in the Far East in December 1941 the requirement for fighters for fleet defence was greatly increased and a review in January 1942 envisaged a need for up to 20 carriers to operate with the fleet.⁵⁸

⁵⁴ Letter from Fifth Sea Lord to First Lord, 10 Jul 1941, ADM 1/12126.

⁵⁵ Ibid.

⁵⁶ Naval Air Expansion Programme (A.001.41), 30 Sep 1941, ADM 1/11938.

⁵⁷ Report from Fifth Sea Lord to First Lord, 30 Aug 1943, ADM 1/14990.

⁵⁸ Minute by D of P and DNAD, 17 Jan 1942, ADM 1/11971.

The major difficulty lay in the complicated construction required to build a Fleet Carrier (CV). Instead design commenced on the Light Fleet Carrier (CVL) which could utilise machinery from cruisers and thus a large saving in production time.

Captain Bridge, Director of the Naval Air Division (DNAD), reported on 15 February 1942 that requirements for June 1944 were now 1464 aircraft, 666 fighters and 798 TBR's. There would be thirty-eight CVEs, thirty American and eight British carrying 648 aircraft, and twenty-four Supernumerary squadrons with 288 machines. For the first time in the estimates were thirteen shore-based squadrons with 156 aircraft and six night fighter squadrons with seventy-two 'planes.⁵⁹ The Head of the Air Branch noted on 2 March that with the addition of 150 Amphibious Bomber Reconnaissance aircraft and Light Reconnaissance aircraft the total would be nearer to 1600, and that while shore-based squadrons had been the prerogative of Air Ministry since Inskip's decision: '...this ruling has been departed from on more than one occasion during the present war, often by arrangement with the Air Ministry.'⁶⁰ Regarding the production of CVEs, the British Admiralty Delegation (BAD) Washington signalled on 16 April that the RN could expect to receive three British and fifteen American CVEs in 1942 with a further twelve per year in 1943 and 1944.⁶¹ Discussions were also taking place in the Admiralty on the possibility of obtaining CVs from the Americans, but Captain Lambe, the Director of Plans, opposed any such approach on 29 April:

'Our need for aircraft carriers may well be more urgent than that of the U.S. and from time to time circumstances may be favourable for obtaining the temporary loan of these ships. In view, however, of the U.S. attitude regarding the 2 ocean navy programme, I am firmly of the opinion that an approach to the President at the present juncture for the transfer of battleships and aircraft carriers has not the smallest chance of success.'⁶²

However plans for CVLs were forging ahead and were approved by Captain D.H. Everett, Deputy Director of Plans on 2 June: '...I believe that we should made every effort to provide Intermediate Aircraft Carriers as soon as possible and propose that the next six cruisers due to be laid down after mid-1942 should be replaced by these carriers.'⁶³ On 8 June the Director of Gunnery and Anti-Aircraft Warfare (DGAAW) supported the

⁵⁹ Report by DNAD, 15 Feb 1942, ADM 1/11938.

⁶⁰ Minute by Head of Air Branch, 2 Mar 1942, ADM 1/11938.

⁶¹ Message from BAD Washington, 16 Apr 1942, ADM 1/11938.

⁶² Minute by D of P, 29 Apr 1942, ADM 1/12058.

⁶³ Minute by DD of P, 2 Jun 1942, ADM 1/11971.

construction of CVLs, especially if the alternative was conversions: 'An "Intermediate" Carrier requires far less productive effort than a Cruiser, and is of far greater general value. "Conversion" Carriers are a poor substitute and, except for their fighters, have virtually no defensive power against aircraft, i.e. their AA armament is negligible.'⁶⁴ On the same day Captain Terry, Director of Operations Division (Foreign), had proposed that the cruisers *Emerald* and *Enterprise* may be converted into CVLs when next were due for refit no doubt provoking the comments from DGAAW.⁶⁵ The Director of Naval Construction reported on 7 August that a further ten CVLs had been ordered in addition to one already in the 1942 Programme and four cruisers had been cancelled to provide the requisite berths and propulsion machinery.⁶⁶

In the autumn of 1942 the requirement for further CVs, to get as many aircraft to sea with the fleet, was approved as Admiral Pound, the First Sea Lord, wrote to Churchill on 25 October 1942:

'The Cabinet has approved Fleet Aircraft Carriers up to the maximum number of slips available. What we still need is the labour to complete the ships quickly and the assurance of aircraft and personnel to man them. There is no possibility of getting Fleet Aircraft Carriers assigned to us by the U.S.A.'⁶⁷

Pound also highlighted a critical need for refrigerated merchant ships as the main reason why the RN was so dependent on America for CVEs. He estimated that on 1 January 1944, there would be between twenty-eight and thirty-seven CVEs in service, depending on the supply from America in 1943 which were estimated at between twelve and twenty-two. The loss of four or five ships had also been taken into account in his calculations.⁶⁸

The Air Branch Acquaint of 4 June 1942 presented the latest version of the Naval Air Expansion Programme to mid-1944 with 1789 first line aircraft. The first four CVLs appeared in the estimates with ninety-six aircraft. In addition there were thirty-five CVEs carrying 663 aircraft and fifteen shore-based squadrons with 180 aircraft. Training and ancillary squadrons required 1150 aircraft, 880 in the first line and 270 miscellaneous for Fleet Requirement Units (FRUs) and communications flights.⁶⁹ On 13 July Admiral Sir Frederic Dreyer, Chief of the Naval Staff (CNAS), laid out a tentative expansion to mid

⁶⁴ Minute by DGAAW, 8 Jun 1942, ADM 1/11971.

⁶⁵ Minute by DOD (F), 8 Jun 1942, ADM 1/11971.

⁶⁶ Minute by DNC, 7 Aug 1942. ADM 1/12156.

⁶⁷ Minute from First Lord to Prime Minister, 25 Oct 1942. ADM 1/12093.

⁶⁸ Ibid.

⁶⁹ Air Branch Acquaint (A.0014.42), 4 Jun 1942, ADM 1/11941.

1946 with two further CVs, nine more CVLs and nine British and twenty-four US CVEs with a total of 1480 strike aircraft and 1264 fighters.⁷⁰ By the end of 1942 the possible number of CVEs had risen exponentially as Dreyer, wrote on 4 December: 'At one meeting of Sea Lords which I attended the intention was that our aim should be to obtain 83 Auxiliary Carriers of which we would man and equip a maximum of 41 at any one time.'⁷¹ Captain Lambe, the Director of Plans explained the thinking behind this figure: 'The number 83 has been estimated as the number required to keep 54 Escort Carriers continuously in operation on the trade routes. The remaining 29 will be refitting, working up or on passage to or from their stations... 10 would require to be fully equipped for amphibious operations...'⁷² Captain Bridge, DNAD, quickly quashed any likelihood of this being achieved: 'D. of P's programme, as shown in his minute of 13th December, is now more of academic interest than real interest, at least as far as the next 2 years or so are concerned, in view of the recent debacle in the aircraft production situation.'⁷³ There was also the possibility of helicopters becoming available for convoy patrols although as Captain Schofield, Director of Trade Division, acknowledged on 16 November 1942: 'It is understood that helicopters or autogyros will not be available in quantity until 1944... It is proposed that further consideration of the design of ships to carry helicopters or autogyros should be deferred until more is known about the M.A.C. ship programme...'⁷⁴

In January 1943 the planned aircraft total for mid-1944 reduced by 339 to 1450. Even so the proposed monthly expansion rate was the highest yet in the war: this had been an average of 2.5% up to April 1941, increasing to 3.3% in October 1941 and 4.9% in April 1942. Even with the proposed reduction in January 1943 the actual expansion rate until mid-1944 remained at 5%, although over the long term the rate until mid-1946 it was only 3.6%.

Aircraft production cuts

By the beginning of 1943 the aircraft production programme had become the greatest single brake on naval air expansion. A memorandum from Air Branch to the First Lord on 12 January recommended the adoption of a revised programme for first line aircraft on the basis of forecast of British aircraft production received from Sir Stafford Cripps, the Minister of Aircraft Production, on 4 January and the disappointing results of

⁷⁰ Letter from Secretary of CNAS to Secretaries of First Lord and First Sea Lord, 13 Jul 1942, ADM 1/12126.

⁷¹ Minute by CNAS, 4 Dec 1942, ADM 1/12164.

⁷² Minute by D of P, 13 Dec 1942, ADM 1/12164.

⁷³ Letter from DNAD to Captain Slattery, 8 Jan 1943, ADM 1/12164.

⁷⁴ Minute by DTD, 16 November 1942, ADM 1/12189.

the Lyttleton Mission to Washington.⁷⁵ Programme A, approved as recently as October 1942, was to be replaced by Programme B which envisaged deficits until 1946, the largest being 595 on 1 January 1944:

Table 2. Comparison between Programmes A & B, October 1942 - January 1943

	Programme A	Programme B	Difference
1 January 1943	875	570	- 305
1 January 1944	1745	1150	- 595
1 January 1945	2072	1750	- 322
1 January 1946	2464	2350	- 114
1 July 1946	2689	2689	0

These cuts would not allow the formation of any Alternative Armament Squadrons, as supernumerary squadrons were now called, until the end of 1944 and the necessity for CVEs to operate two-thirds of their normal complement and with largely obsolete aircraft, mainly Fairey Swordfish, in the immediate future. A report by Dreyer, CNAS, on 13 January blamed Oliver Lyttleton, the Minister of Production for the delays: ‘To him we owe the temporary but severe cut in the reserves... we shall not get any Alternative Armament Squadrons until about the end of 1945.’⁷⁶ The smaller scale of reserves allowed by Programme B meant fewer first line aircraft could be maintained and hence the scrapping of plans for Alternative Armament Squadrons in the short term. Nevertheless Dreyer predicted the number of FAA personnel would grow from 34,000 in January 1943 to 77,000 in 1944. Adding to the general sense of gloom about aircraft availability Alexander, the First Lord, wrote to Archibald Sinclair, the Secretary of State for Air on 2 February 1943:

‘It is clear that 1943 is going to be a bad year for us. It will be impracticable to form a single alternative armament squadron, and we estimate that even if all our existing shore-based squadrons are disbanded and reserves of all kinds reduced to a minimum, there will still be shortages during the year of about 700 T.B.R.s and 200 single-seater fighters.’⁷⁷

Programme B was formally accepted in March 1943 as Rear Admiral Boyd, the Fifth Sea Lord, informed Admiral Pound, the First Sea Lord, on 30 August:

⁷⁵ Memorandum from Air Branch to First Lord, 12 Jan 1943, ADM 1/14873.
⁷⁶ Report by CNAS, 13 Jan 1943, 8, ADM 1/13484.
⁷⁷ Letter from First Lord to Secretary of State for Air, 2 Feb 1943, ADM 1/14873.

‘Towards the end of 1942 it began to appear that in the near future the bottleneck would be in aircraft and personnel rather than ships. It was recognised that [a] shortage of man-power and productive capacity made it impossible to meet the needs of the Navy, and a “realistic” expansion programme up to mid 1946 was prepared, providing for a slower increase in the I.E. [Initial Establishment] in the initial period.’⁷⁸

The one bright spot for the long term was the resumption of the CV programme with the recognition of the importance of getting more aircraft to sea with fleet. A memorandum by Admiral Kennedy-Purvis, the Deputy First Sea Lord, on 16 January 1943 envisaged a reorientation of naval building policy: ‘...it is clear that the aircraft carrier must form an indispensable part of every naval force taking part in all operations other than purely minor and coastal ones...to continue to employ battleships whose main role becomes that of AIRCRAFT CARRIER HEAVY SUPPORT SHIP.’⁷⁹ Accordingly the optimum future ratio for the fleet would be two and half CVs and two CVLs to one battleship, five and half cruisers and twenty-one destroyers. Four CVs of an improved design were ordered in 1943 although this was later reduced to three on account of shipbuilding capacity. One was to be completed in 1947 and two in 1948.⁸⁰ No battleships or cruisers were included in the building programme as Alexander, the First Lord noted ‘As our need for aircraft carriers is relatively much greater, I do not include any battleships in this programme as they can only be built at the expense of Fleet carriers.’⁸¹

The availability of CVEs was confirmed by the Americans as Captain Lambe, Director of Plans, reported on 5 October 1943: ‘Owing to our follow-on programme for C.V.Es in U.S. being refused, the optimum number of operational carriers upon which we can now count is 38 which is subject to diminution by casualties.’⁸² In fact by the end of the war forty-four had been delivered. The allocation of Alternative Armament Squadrons was formalised at one for every two squadrons in CVs or CVLs and one for every four in CVEs, but the shortages of aircraft prevented any being formed. In addition catapult aircraft were eliminated from capital ships and cruisers by mid-1943 as it was deemed more profitable to employ the space for enhanced anti-aircraft armament.

⁷⁸ Report from Fifth Sea Lord to First Lord, 30 Aug 1943, ADM 1/14990.

⁷⁹ Memorandum by Deputy First Sea Lord, 16 Jan 1943, ADM 1/12836.

⁸⁰ Ibid.

⁸¹ Geoffrey Till, *Air Power and the Royal Navy*, 181.

⁸² Minute by D of P, 5 Oct 1943, ADM 1/12731.

Manpower and the war against Japan

By the end of 1943 the lack of manpower was becoming an increasing factor in restricting the expansion of the FAA. Captain Lambe, the Director of Plans, stated that the Navy needed 17,000 men from the RAF in 1944 to meet its commitments. If none of these were forthcoming the FAA would be short of 2,000 maintenance ratings and none would be available for the Pacific.⁸³ Accordingly in December 1943 Captain Moore, the Assistant Director of Plans (Air), approved a reduction first line strength on 1 January 1945 from 1750 to 1635.⁸⁴ The CVs *Indefatigable* and *Implacable* would be commissioned and forty-two CVEs would be in service together with one Air Store Issuing Ship (ASIS) and one component repair ship by mid 1944 and one engine repair ship and one maintenance ship by October 1944. But up to seven more aircraft repair Ships, two ASIS and two maintenance ships would be put in care and maintenance on completion between October 1944 and March 1945. This did not mean that the Navy had ordered too many air repair ships, but merely that they could not be manned until the FAA was able to concentrate on the war against Japan. In addition only one CVL would be manned and another six placed in care and maintenance between October 1944 and April 1945. Nevertheless the squadrons for all the CVLs would be formed enabling them to become operational as soon as possible after Germany's defeat when personnel would be released to man the ships.⁸⁵ The new policy was based on the priority afforded to the war with Germany and the need to carry out the greatest possible preparations for a Pacific deployment in the light of manpower limitations:

‘...the reduction to care and maintenance, until Germany is defeated, of ships and facilities not required against Germany except for:-

- (i) What is necessary to fulfil our previously agreed commitments in the Far East.
- (ii) What is necessary to keep the F.A.A. expansion alive and so prevent an inordinately long delay between the defeat of Germany and the time when we can exert our proper influence against Japan.’⁸⁶

The overall reduction announced by Moore may have only been 115, but it masked a large change in types. There would be 216 more strike aircraft, 371 fewer fighters and forty helicopters were also included for the first time in an expansion plan. The number of

⁸³ Paper by D of P, 27 Dec 1943, ADM 1/16439.

⁸⁴ Report by AD of P (A), Dec 1943, ADM 1/16439.

⁸⁵ Ibid.

⁸⁶ Ibid.

strike aircraft was also likely to fall as 220 Swordfish were included in the estimate, but production of the aircraft was due to end in 1944. Air Branch acknowledged that further alterations were highly likely: ‘...the subject of further discussion between the staff and D.A.E. when we know for certain what the Washington Mission had achieved and precisely what effect the cuts in production at Home will have on this year’s programme of expansion.’⁸⁷ There was little change in the training and ancillary strength from 2007 in Programme A to 1980 in Programme B. Rear Admiral Portal, ACNS (A), recommended on 20 January 1944 that Programme B should be adhered to: ‘The future strength of the Fleet Air Arm is now in doubt, owing to the present difficulties over assignments of aircraft from the U.S.A. Nevertheless an approved policy is necessary for administrative and planning purposes, particularly with regard to economical distribution of manpower... we should continue working to “Programme B”, unless and until it is clear that we cannot achieve it.’⁸⁸

In August 1944 Admiral Cunningham, the First Sea Lord, informed Vice Admiral Boyd, the Fifth Sea Lord, of the new parameters of national strategy and manpower within which FAA expansion would have to operate:

‘An overall reduction in Naval manpower of some 25% will be necessary within 12 months after the defeat of Germany.

2. For planning purposes it is assumed that Germany will be defeated in October 1944, and Japan two years later.

3. In order to calculate the reduced manpower requirements for Naval flying service, you should organise the expansion of the first line strength of naval aircraft at the maximum impact which can be brought against the enemy by 1st October, 1945, thereafter stabilising at that strength.’⁸⁹

Planning in early 1944 called for 2689 aircraft by mid-1946, but the initial success of Operations ‘Overlord’ and the progress of Allied armies in the summer of 1944 saw the first line peak brought forward for the war with Japan to 1 October 1945 at strength of 1,800.⁹⁰ Manpower shortages saw this later reduced to 1605. While aircraft production proceeded, the availability of personnel lagged behind and the works embargo before Operation ‘Overlord’ delayed the construction of airfields. Furthermore the FAA’s programme was dependent upon the transfer of further airfields in Britain from the RAF

⁸⁷ Paper by Air Branch, 8 Jan 1944, ADM 1/16439.

⁸⁸ Minute by ACNS (A), 20 Jan 1944, ADM 1/16439.

⁸⁹ Minute from First Sea Lord to Fifth Sea Lord, 12 Aug 1944, ADM 1/16414.

and this was not likely until Germany's defeat; these were required to support the FAA's final expansion drive which would not be completed until the autumn of 1945. Out of the 1605 aircraft, 501 were strike, 1074 fighters and 30 amphibians. These would equip six CVs, ten CVLs, sixteen Assault Carrier CVEs, nine trade route CVEs and eleven Alternative Armament squadrons. The last CVL, HMS *Magnificent* was expected to be completed in December 1945.⁹¹ The notes prepared by Air Branch for Ministers on 19 February 1945 summed up the increasing juggling of resources than now characterised air expansion: '1944 has seen a deep intensification of the Navy's preparations for the air war against Japan. The relationship between the four factors on which naval aviation chiefly depends – aircraft, carriers, airfields and personnel – continued to become more and more complex.'⁹²

To add to this complex situation on 19 January 1945 Admiral Bruce Fraser, C-in-C British Pacific Fleet, proposed one of the most radical changes to the FAA's organisation since 1939 with the adoption of a system of spare Carrier Air Groups similar to that of the Americans: '...such a policy in the British Service would be revolutionary since we have always stressed the importance of the close relation of the Carrier and her aircraft... It would be unreasonable to expect our aircrews to undertake the same scale of operations as the Americans in the same area without some comparable terms of service.'⁹³ Each Carrier Air Group would now be relieved by another at six monthly intervals when Air Group tours had previously lasted at least twelve months. If this system was adopted it meant that the number of operational carriers would have to be reduced since there was no possibility of forming a larger number of squadrons than hitherto proposed. Fraser's suggestion was in recognition that his aircrews were about to undertake operations of a duration and intensity which had no parallel for the RN in the Second World War; in an official analysis fourteen Fleet Carrier operations between March-October 1944 were dismissed thus: 'Since this type of tip-and-run raid is likely to be put out of date by the operations of the British Pacific Fleet, it is not proposed to analyse those strikes any further.'⁹⁴

The programme in 1944 had based on providing CVs and CVLs with interchangeable air groups of either two fighter and one TBR squadron or one fighter and one TBR squadron utilising eleven Alternative Armament squadrons. A memorandum on 8

⁹⁰ Message from Head of Air Branch to BAD, 30 Aug 1944, ADM 1/16484.

⁹¹ The number of aircraft in detail were as follows: 6 CVs (423), 10 CVLs (420), 16 Assault Carriers (384), 9 trade route CVEs (162), 11 spare squadrons (186) and amphibians (30).

⁹² Notes on 'Naval Air Matters' for Ministers from Head of Air Branch, 19 Feb 1945, ADM 1/17399.

⁹³ Message from C-in-C, BPF to Admiralty, 19 Jan 1945, ADM 1/17385.

⁹⁴ Report No.60/45 'Analysis of British carrier strikes' by Department of Operational Research, 1945, ADM 219/262.

March 1945 by Captain Byas, DNAO, concluded that in practice no need had been found for this arrangement. The programme was also suffering limitations from manpower shortages and tactical requirements were rapidly changing with a greater need for CVEs for ferrying, a new requirement for them to operate in the replenishment role and Fraser's request for spare air groups. These modifications and the continuing war against Germany meant the programme was again delayed: 'The date for reaching the figure [1605] was originally cast as 1.10.45 but the prolongation of the European War and other factors have caused that date to be deferred and it is now nearer 1.1.46.'⁹⁵ The formation of spare air groups would be possible in the proportion of 100% for CVs, 50% for CVLs, but none for CVEs. However, those for CVLs were not to be available until 1946. Byas estimated on 24 March that a peak of 1608 aircraft would be reached in April/May 1946.⁹⁶

For the success of the spare air group plan within this limit a radical programme of cuts were outlined by the Head of the Air Branch on 6 April 1945 including the reduction of the aircraft establishment of Illustrious Class carriers from fifty-four to forty-five and that of CVLs from fifty-four to thirty-three. The number of Assault CVEs was to be slashed from sixteen to eight and later six and other CVEs from six to two or none as CVLs came into service.⁹⁷ The detailed make up of the aircraft types were dependent upon the assignments of aircraft from America in the last six months of 1945 and the first six months of 1946. On 8 June Captain Byas confirmed a programme of 1662 aircraft to equip six CVs, thirteen CVLs, eight Assault and two General Purpose CVEs, with 100% spare groups for CVs and 50% for CVLs. Out of the 1662 aircraft, no fewer than 666 or 40% were now allocated to spare air groups.⁹⁸

The developments of 1945 marked a most remarkable change in the organisation of naval aviation when the requirement to get the largest number of ships with the most aircraft to sea was replaced by the need for sustained operations. For much of the war only lip service had been given to building up reserve formations whereas spare air groups now formed the heart of the programme. The large force of CVEs which the navy had strived to build up was suddenly largely obsolescent as far as front line operations were concerned and the idea of reducing carrier complements became an acceptable formula to maintain operations in the long term.

⁹⁵ Memorandum by DNAO to DAWT and DAMR, 8 Mar 1945, ADM 1/17385.

⁹⁶ Notes by DNAO for meeting under ACNS (A), 24 March 1945, ADM 1/17385.

⁹⁷ Minute by Head of Air Branch, 1 Apr 1945, ADM 1/17385.

⁹⁸ Message from DNAO to C-in-Cs, 8 Jun 1945, ADM 1/17385.

Chapter 3 – Strategy and Naval Air Bases

Overview

Naval air stations are the backbone of naval aviation and yet the coverage they have received has been relatively limited compared with the other aspects of the service. With the personnel, carriers and aircraft, airfields were one of the four major building blocks of the RNAS and the FAA, but possess neither the glamour of the aircraft nor the specifically front line role of the carriers. Consequently authors have tended to neglect them in favour of the more specifically ‘naval’ facets, airfields being more associated with the RAF.

The unique nature of air logistics within the Navy is that separate air bases are required in addition to the traditional dockyards. Devonport, Portsmouth and Singapore might have been lynchpins for maintaining the fleet in 1939, but they were of little use when a carrier needed to fly its aircraft ashore. For basic and refresher aircrew training, accommodation of disembarked squadrons, aircraft maintenance and repair and storage of reserve aircraft, air bases were essential. The major factor which was relevant in 1914 and 1939 was that, in comparison with dockyards, a major build up of air bases was necessary in wartime from almost a standing start. This was especially important for the FAA, which had a carrier force to maintain, but was without a shore-based organisation to support it.

The decision of the dual control arrangement to place the carriers under naval control, but all land-based support in the hands of the RAF was an extremely serious weakness when the RN regained control in May 1939. It was not only air stations which the FAA lacked, but aircraft repair yards and air store depots. Therefore the transfer of four airfields by the RAF in 1939 only addressed part of the problem. There were few Air Engineer Officers to advise on requirements. In all aspects the FAA’s shore facilities were inadequate when war broke out and it struggled to compete with its larger sister service.

The Naval Air Expansion Programmes had the most direct impact on the air station requirements in Britain, Canada and America which were largely used for training, working up of squadrons and disembarked units. It was extremely difficult to co-ordinate the availability of airfields compared with other elements of the programmes since new air stations took years of planning and construction, but were afforded less of a priority, undoubtedly a throwback to the late 1930s where consideration of shore-based facilities was a largely academic exercise since they were all controlled by the RAF. The expansion programmes were laid down according to carrier construction from which the planning for airfields and the associated repair yards and store depots seemed somewhat divorced at least until 1942. One obvious, but major problem was that airfields took a substantial time

to construct and whereas the time to build ships or train aircrew and work up squadrons was taken into account, that for the construction of airfields was not.

Requirements overseas were much harder to predict being largely dependent on the strategic direction of the war. If facilities available from the RAF in Britain were limited then those overseas were even more so. Many of the RAF's air stations abroad were completely inadequate even for its own needs, never mind the FAA. Some requirements such as those on trade routes were apparent from the beginning of hostilities, while others in the Mediterranean and Far East had to be built up according to often changing strategic plans and operational needs.

One of the fundamental differences between the experiences of 1914-1918 and 1939-1945 was that the RNAS was largely a land-based organisation and utilised its stations for operations as well as training, making them more significant in first line operational terms than for the FAA. Therefore in the overall structure of organisation, the shore bases in the First World War were in the front line, a role largely occupied by carriers in the later conflict. In many ways its role was more that of Coastal Command than supporting the fleet.

Some of the RNAS's larger weapons systems such as flying boats and airships could only operate from land-bases with specialist facilities. The RNAS could depend on its own stations for all its needs and these were located to a large extent in Britain, the main exception being the Mediterranean. The biggest operational base was at Dunkirk, but this could be readily supplied from home stations and reinforcements flown across the Channel. Aircrew training and aircraft production facilities were concentrated in Britain although some training facilities were transferred to France in 1916 and it was proposed to establish some in Canada. In comparison the FAA's top priority was to sustain carriers worldwide; whether at Gibraltar or in Egypt in the Mediterranean, Canada for the North Atlantic or Ceylon in the Indian Ocean the base requirements overseas increased, especially as operations were dramatically increased in the Indian Ocean and Far East in 1944-1945.

The construction of airfields in the First World War presented widely differing propositions; stations for aeroplanes were often simple affairs with a grass runway and limited facilities. Some of them, for example landing grounds with a few fighters for air defence of Britain were not intended to be permanent so local accommodation was used to house personnel, the construction limited to the sheds, workshops and essential facilities. At the other end of the spectrum the rigid airships required enormous sheds to be built before the airships themselves could be constructed. Seaplane stations also required substantial investment, especially with the introduction of large flying boats which needed

concrete slipways and large sheds; when it was proposed to operate flying boats in the Mediterranean it was necessary to allocate part of the facilities at Malta Dockyard.¹

Since the RNAS performed both fleet support and coastal command roles and aviation was in its infancy there was little difficulty in obtaining sites. With Coastal Command under the RAF's umbrella and as such having the first choice of facilities it retained a number of stations at key maritime locations. The location of stations were important, usually near ports for aircraft to be flown ashore or unloaded, for units involved in navigation exercises, torpedo training and deck landing practice with areas around the Clyde and Liverpool becoming increasingly important. Because most RNAS units in Britain in the First World War were not organised into squadrons, but allocated to stations in accordance with operational need, deployments sometimes consisted of a small number of aircraft or airships.

The grass runways, which had been acceptable in the First World War, had been replaced by tarmac and a much larger infrastructure was required to accommodate much larger and more technologically advanced aircraft. The wide-range of skills and equipment required stations specialising in different roles and as the Second World War progressed units had to spend more time re-training on new aircraft or equipment; Lieutenant George Sadler recalls answering a question at the FAA Drafting Unit in November 1944 regarding his training experience: 'I reeled them off – Torpedo Dropping, Deck Landing, Catapult, Instrument Flying, Western Approaches, Rocket Projectile, Safety Equipment, Rocket Assisted Take Off and Barracuda Conversion courses. He conceded that I had done all the relevant courses for a TBR pilot...'² It required a juggling of resources between different types of training which needed different locations and equipment.

The analysis will be split between the requirements at home and abroad. In the case of the First World War to examine the facilities for the various weapons; aeroplanes, seaplanes, airships and kite balloons and then a brief summary of the experiences of establishing bases overseas. For the FAA the divide, albeit somewhat artificial, will be made between the bases for training and disembarked squadrons in Britain, Canada and America and the development of operational stations abroad.

¹ Report by Wing Commander Longmore, 19 Jan 1918, AIR 1/649/17/122/408.

² George E. Sadler, *Swordfish Patrol* (Wrexham: Bridge Books, 1996), 109.

First World War

Coastal stations, 1912-1914

After the failure of the Navy's first airship, *Mayfly*, in 1911 pre-war planning was dominated by the need for seaplane stations. As the Admiralty informed the Admiral Commanding the Coast Guard and Reserves in November 1912: '...their Lordships have approved the gradual establishment of a regular chain of stations for naval aircraft along the Coasts of the United Kingdom within easy flight of each other.'³ Sixteen stations were planned around the south and east coasts of Britain from Pembroke to Scapa Flow. Airships stations were to be located at the delightfully named Teapot Head near Chatham, on the Norfolk Broads and at Rosyth.

In August 1913, Commodore Sueter, the Director of the Naval Division (DAD) directed that the districts of Cromarty, Rosyth, Newcastle and Sheerness should have priority and Churchill, the First Lord, agreed that it was necessary to prioritise aircraft and personnel:

'Although the establishment of seaplane bases along the south and east coasts is necessary on strategic grounds... I do not consider it desirable at present to occupy and man them all... not more than four bases (including the experimental bases) for seaplanes should be occupied in the current year.'⁴

A similar contraction of the programme was ordered by Churchill in June 1914: 'Only five naval air stations instead of eight will be developed this year, the money and personnel assigned to the whole being concentrated on the five.'⁵ By the outbreak of war six seaplane stations had been established⁶ and an airship station was being built at Kingsnorth.

At a meeting on 3 August 1915 Admiral Sir Henry Jackson, the new First Sea Lord, criticised the RNAS on account of its large uncontrolled expansion and the waste of money on air stations, but was rebuffed: 'Commodore Sueter... on being asked which of the present or projected stations could be done away with, stated definitely that in his opinion none should be done away with and he thought more would be required... circumstances varied but that in round numbers about one [station] every 100 miles should be for patrol work – Later on Commodore Lambert quoted this as an instance [where] this particular

³ Letter from Admiralty to Admiral Commanding Coast Guard and Reserves, 2 Nov 1912, Doc. No20, in Roskill, *Documents Relating*, 61.

⁴ Minute from First Lord to Second Sea Lord and DAD, 12 Nov 1913, Doc. No.36, in Roskill, *Documents Relating*, 116.

⁵ Minute from First Lord to Secretary of Admiralty et al, 9 Jun 1914, Doc. No.42, in Roskill, *Documents Relating*, 143.

problem has been most thoroughly discussed and worked out in detail.’⁷ This view would appear to concur with Churchill’s careful application of resources in this instance, rather than his more profligate view of aircraft production.

Comparative costings and constructional labour

The table of works for RNAS installations approved in July 1915 reveals the wide range of facilities and the comparative cost of the various types of installations.⁸ The cheapest were for aeroplanes, Eastchurch being the sole pre-war station costing £24,110. Up to July 1915 a further £128,700 was earmarked for Eastchurch and £120,500 allocated for 11 new stations⁹ plus twenty aeroplane sheds to be split equally between home and abroad and two stand-by sheds. Five seaplane stations¹⁰ were built in the pre-war period at a cost of £64,390 and until July 1915 another £120,435 was allocated for their expansion and £122,760 for eight new stations.¹¹

By far the largest slice of the RNAS’s construction budget was taken up by airships. The four authorised pre-war stations were to cost £284,500.¹² Between August 1914 and July 1915 further investment of £28,600 was allocated to Kingsnorth and £162,925 to another ten air stations¹³ plus five portable airship sheds. Eight more stations were planned at a cost of £920,000.¹⁴ Of the total of £1,946,830, £725,000 had been spent by 30 June 1915 and a further £761,830 would be spent by the end of the 1915-1916 financial year. Only £460,000, half of the allocation for the eight new airships stations, would remain for works later in 1916. Works costing the remaining £144,500 were cancelled by the Admiralty.

By far the most extensive and expensive installations were the airship sheds. Two sheds for rigid airships on the Humber and at Pulham in Norfolk measuring 600 feet long, 150 feet wide and 100 feet high each cost £80,000, while the standard shed holding two non-rigids was 320 feet long, 150 feet wide and 80 feet high cost £30,000 each. By contrast one of the most extensive seaplane bases, Killingholme, had four 70 feet by 70 feet sheds

⁶ Cromarty, Rosyth, Harwich, Isle of Grain, Dover, and Calshot.

⁷ Report of meeting held by First Sea Lord, 3 Aug 1915, Doc. No.75, in Roskill, *Documents Relating*, 217.

⁸ Table of works authorised by the Admiralty Board to be carried out by Director of Works Department in connection with Air Services, 31 Jul 1915, AIR 1/146/15/58.

⁹ Dover, Hendon, Dunkerque, Newcastle, Chingford, Chelmsford, Maidstone, Westgate, Eastbourne, Kingsnorth and Scarborough.

¹⁰ Calshot, Felixstowe, Yarmouth, Dundee and Fort George.

¹¹ Scapa Flow, Loch Strathbeg, Killingholme, Clacton, Dover, Bambridge, Dunkerque and Isle of Grain.

¹² Kingsnorth, Pulham, Farnborough and Wolverhampton.

¹³ Wormwood Scrubs, Barrow, Dover, Polegate, Anglesey, Luce Bay, Dunkerque, Marquise, Roehampton and Gallipoli.

¹⁴ Pembroke, Mullion, Selsey, Norfolk, Humber, Tyne District, Rosyth and North of Aberdeen.

and a temporary slipway constructed at a cost of only £5,400 while three pairs of large sheds for aeroplanes and associated outbuildings at Eastchurch amounted to only £4,980.

Co-ordinating airfield construction was the Station Construction and Equipment Committee. Because air power was new and relatively underdeveloped at the start of hostilities, the Air Service Construction Corps (ACC) was formed to build RNAS stations and was manned by forty-eight officers and 1500 men by January 1917. The biggest contingent was at Pulham airship station comprising seventeen officers and 593 ratings. Other significant units included ten officers and 325 ratings at Houton Bay, Scapa building five kite balloon sheds, three officers and 156 ratings at Vendome training school in France, four officers and 140 ratings at Howden airship station and three officers and 134 ratings at Cranwell. Smaller contingents were to be found at Polegate, Dunkirk, Crystal Palace and the Admiralty.¹⁵

Not all construction was carried out by the ACC. Of the eight rigid sheds planned in April 1916 those at Aberdeen, Howden, Pulham, Cranwell and East Fortune were to be constructed using naval labour, whilst outside contractors would be brought in at Selby, Inchinnan and Bedford.¹⁶ In France or other areas where Expeditionary Forces were operating, construction was undertaken by Army labour battalions, but these were unavailable in certain areas of the Mediterranean prompting recruitment of local labour on Malta as C-in-C Mediterranean reported in September 1918:

‘Enlistment of native Maltese recruits for the RAF has been proceeding for the last five months, and, at present just under 700 recruits have been obtained. The total numbers aimed at are 2000. These men are all unskilled “labourers”... In the Adriatic and the Aegean (especially the latter) a very large amount of labour work has to be formed [sic] – such as building, road-making, drainage, sanitation, land and water transport... already 100 of these [Maltese] men have been drafted to the Adriatic and 150 to the Aegean, while 50 are employed at the seaplane station, Malta.’¹⁷

The availability of specific labour units was a considerable fillip for the RNAS, although in some cases temporary facilities were erected to save time and resources and get bases into service faster.

¹⁵ Weekly report of Air Service Constructional Corps, 4 Jan 1917; Minutes of meeting of Station Construction and Equipment Committee, Lighter-than-Air Section, 1 Dec 1916, AIR 1/149/15/100.

¹⁶ First Lord's RNAS fortnightly return, 16-30 Apr 1916, AIR 1/150/15/113/2.

¹⁷ Report from Vice Admiral, C-in-C Mediterranean Station to Secretary of Admiralty, 8 Sep 1918, AIR 1/649/17/122/409.

Aeroplane Stations

Aeroplane stations in Britain formed the basis of the RNAS's flying training. The makeshift pre-war organisation saw pilots trained at private flying schools including the Grahame White School at Hendon. Later in the war most recruits joined the RNAS depot at Crystal Palace for initial naval training before undertaking initial flying training at Eastchurch, Chingford, Redcar or Vendome. Advanced training for most pilots was carried out at Cranwell with prospective seaplane pilots then proceeding to Calshot for specialist instruction. Eastchurch also housed the observer and gunnery schools. Chingford aerodrome appeared to have a fairly notorious reputation as far as novice pilots were concerned. Gordon Hyams recalled his experience there in 1917: '...a very rough aerodrome with a lot of streams running across it and they had board bridges across where you had to taxi... the other side of the road was the King George V reservoirs, which had great attraction for people with engine trouble, there were quite a lot of them.'¹⁸

In the spring of 1916 the poor weather conditions in Britain were recognised as a major impediment to the training programme as Rear Admiral Vaughan-Lee, the Director of Air Services, noted: 'The continuance of the present weather conditions in this country having brought the training of air pilots practically to a standstill, it is desired, if possible, to establish temporarily a training Aerodrome in France.'¹⁹ A suitable site near Vendome was chosen in June 1916 and largely completed by 1917: 'There are 6 Aeroplane Sheds each 180' x 80' and each to hold about 12 machines... Two of the sheds are completed and the remainder are practically completed...'²⁰ Accommodation was necessary for the station personnel of thirty-six officers and 600 men. Pending the arrival of the huts for the first fifty trainee officers, they would be accommodated in houses rented in Vendome. On the commissioning of Vendome, Eastbourne would be closed down, but this expectation was short lived as D.A.S. reported on 5 April 1917: 'In order to meet the increasing demand for Pilots, it is found necessary to provide an additional training school and it is, therefore, proposed to re-open the R.N. Air Station, Eastbourne on the 1st May 1917...'²¹ Ultimately it was planned to have 100 officers under instruction at Vendome each undertaking initial flying training comprising 20 hours in the air and a series of lectures. Philip Bristow was posted to Vendome in 1917: 'We had to parade twice a day on what was called the quarter

¹⁸ G.F. Hyams, IWM/SA 10409, Reel 1.

¹⁹ Minute by DAS, 29 Mar 1916, ADM 1/436/15/276/2.

²⁰ Report from CO, RNAS Vendome to DAS, 1917, AIR 1/436/15/276/1.

²¹ Minute by A.V. Vyvyan for DAS, 5 Apr 1917, AIR 1/635/17/122/119.

deck... We had a flagstaff which flew the White Ensign and everything was dealt with in naval terms. We all wore naval uniform and it was treated just like a ship...²²

Some of the training was undertaken in Canada at the Curtiss Flying School in 1915, but poor weather here like in England prompted the Vice Admiral, Director of the Naval Service in Ottawa, to contact the Admiralty on 21 September: 'There are, at present, approximately one hundred and thirty candidates... The weather conditions during the past summer have been exceptionally bad for flying purposes as there has been a great amount of rain and high winds.'²³ In reply Bonar Law, the Secretary of State for the Colonies, signalled the Governor General of Canada on 10 November: '...Admiralty ask that candidates for Naval Air Service may be sent home to complete training. 48 can be accepted during next two months and should be sent in batches of 12, remainder after New Year up to total of 150.'²⁴

Responsibility for the air defence of Britain was an unexpected and ultimately unwanted role foisted on the RNAS in 1914 when the RFC was despatched to France. The aerodromes established were largely temporary affairs with a few aircraft and when the RFC took over the role in 1916 a number of the landing grounds were transferred including Goldhanger, near Maldon and Narborough in March 1916: '...all fixtures will be turned over, but that portable plant, tents, stores and transport should be returned to R.N.A.S. Central Depot, White City, and that all ranks and ratings employed on the grounds should be withdrawn forthwith.'²⁵ The inability of the aeroplanes to undertake their anti-Zeppelin role effectively caused the Rear-Admiral Commanding, East Coast of England, to question the whole effectiveness of the aeroplane patrols in February 1916:

'...I do not consider any system of coast patrol by land machines can provide an appreciable protection against the enemy's airships... a chain of seaplane carriers stationed... is the true line of air defence as long as we have no airships of our own... the land machine stations at Whitley Bay, Hornsea and Scarborough should be abolished, and I would add Redcar to the list.'²⁶

²² C. P Bristow, IWM/SA 13718, Reel 2.

²³ Letter by Vice Admiral, Director of Naval Service Ottawa, to Secretary of Admiralty, 21 Sep 1915, AIR 1/656/17/122/552.

²⁴ Message from Secretary of State for the Colonies to Governor General of Canada, 10 Nov 1915, AIR 1/656/17/122/552.

²⁵ Minute by DAS, 14 Mar 1916, AIR 1/146/15/55.

²⁶ Letter from RAC, East Coast Of England to Secretary of Admiralty, 25 February 1916, AIR 1/635/17/122/121.

The Admiralty maintained that the shore stations did have a role: ‘...they [Their Lordships] concur in the view that aeroplanes are of little use against Zeppelins at night; at the same time some aeroplanes must continue to be stationed on the coast in order to prevent Zeppelins attacking in broad daylight.’²⁷ Accordingly Redcar was retained, but Whitely Bay closed once the RFC had assumed control of air defence of Newcastle and South Shields seaplane station had been completed.

The importance of having airfields suitable for the higher performance aircraft entering service was highlighted by the Divisional Commander of Air Stations, The Nore, in March 1916: ‘The Commanding Officer, Westgate... has drawn attention to the dangerously restricted nature of the Westgate aerodrome. This danger is very much increased when using fast machines as they require a much larger space in which to land...’²⁸ Accordingly Westgate’s aircraft, pilots and forty ratings were transferred to nearby Manston three months later.²⁹

In addition to the training and air defence roles, a new requirement for aeroplane stations arose in 1917 with the increase in the number of aeroplanes on Grand Fleet ships highlighted by Captain Schwann of *Campania*:

‘...[a] great need that arises [is] for the provision of good facilities at Fleet Bases for the aeroplanes to alight on land and be re-embarked in ships... Owing to the Fleet being generally at four hours notice for steam and to practically no ships being able to carry more aircraft than may be required for service, it is essential that facilities be provided for embarking aircraft, personnel and stores in a very short time... facilities... at Rosyth and Scapa Bases are at present totally inadequate.’³⁰

Rear-Admiral Phillimore, Admiral Commanding Aircraft, Grand Fleet supported the requirements for facilities at both at Scapa and Rosyth:

‘... Pilots will require more practice... and it is hoped to give them plenty of work by lending them for 4 or 5 days at a time to Turnhouse Aerodrome... Smoogroo will have accommodation for half a dozen pilots landed there for practice. The Grand Fleet Aerodromes and bases are:- Donibristle, Rosyth,

²⁷ Letter from Secretary of Admiralty to RAC, East Coast of England, 6 March 1916. AIR 1/635/17/122/121.

²⁸ Letter from DCAS, The Nore to C-in-C, The Nore, 29 Mar 1916, AIR 1/646/17/122/342.

²⁹ Minute by DAS, 9 Apr 1916, AIR 1/646/17/122/342.

³⁰ Letter from CO, HMS *Campania* to C-in-C Grand Fleet, 9 Sep 1917, AIR 1/436/15/279/1.

Turnhouse, Smoogroo, Rosyth. Of these Donibristle and Scapa are for repair work...'³¹

By the end of the war 388 aeroplanes were allocated to the ships and shore stations of the Grand Fleet. There were 340 officers, of whom 204 were pilots and 1552 ratings and 161 Wrens. In addition to the four carriers of the Flying Squadron, aircraft were carried on thirty-seven other warships.³²

Seaplane stations

RNAS Calshot was the hub of the seaplane element of the service where the training of seaplane pilots was carried out after their instruction on aeroplanes. Grahame Donald trained at Calshot in 1915: '...it was a very permanent naval air station. It had been built as a naval air station with concrete slipways and permanent sheds...'³³ Commodore Godfrey Paine, Director of Air Services (DAS), visited Calshot in May 1917 and noted that the lack of progress on accommodation was affecting the expansion of the service: '...the men's and officers' quarters were proceeding far too slowly. Things must be hastened, or delay in production of pilots will occur...'³⁴ Gordon Hyams arrived at Calshot in June 1917 and was highly satisfied by his accommodation in the local area: 'Well we lived one side of the river in a place called Warsash in a very nice country house, very comfortable there and we crossed over to Calshot on the other side of the water in a paddle steamer.'³⁵ The use of civilian accommodation seems to have been a reasonably frequent occurrence; seaplane pilot Philip Bristow was training at Lee-on-Solent in 1918: '...I was quartered in a very nice residential house on the top of the cliff. Several of these had been commandeered by the Navy...'³⁶ To supplement training in Britain in 1917, thirty-five Canadian seaplane pilots a month were receiving initial flying training in Canada before coming to Britain and the Air Department hoped this training could be extended: '...If time permits, endeavours might be made to complete the seaplane training of all these pilots, and they would then only require a "polishing" course at Cranwell on their arrival in England.'³⁷

³¹ Lecture 'The Future and Possibilities of the Air in Naval Warfare' by Rear Admiral Sir R. Phillimore, Imperial War Museum/Department of Documents 96/33/1 [Further references to Imperial War Museum/Department of Documents will be referred to as IWM/Doc].

³² Paper by Rear Admiral Sir R. Phillimore for Committee of the Navy League, Apr 1920, IWM/Doc 96/33/1.

³³ G. Donald, IWM/SA 18, Reel 4.

³⁴ Report of visit by DAS to Calshot, 19 May 1917, AIR 1/150/15/108.

³⁵ G.F. Hyams, IWM/SA 10409, Reel 3.

³⁶ C.P. Bristow, IWM/SA 13718, Reel 2.

³⁷ Minute by Wing Commander, Air Department, 21 Feb 1917, AIR 1/151/15/115.

In July 1917 there was argument over the need for a seaplane training school in the Mediterranean; Captain Vyvyan, Naval Assistant to DAS, believed that: ‘...requirements of seaplane pilots are at present being met at the home schools, and the establishment of a training centre in the Mediterranean is not considered necessary.’³⁸ The Director of Operations Division did not agree that facilities in Britain could cope: ‘... the number of seaplane pilots is now approximately 300 and is increasing steadily... With present resources it is unlikely that this rate [of training] can be maintained through the winter months... Malta and Taranto as proposed should be kept in view.’³⁹

A further difficulty in choosing locations for the seaplane bases were the calm conditions required for fragile seaplanes to operate. Gerald Livock joined Great Yarmouth as flight commander in December 1916: ‘Yarmouth was a most unsatisfactory base for seaplanes as the slipways were on the coast and our poor old aircraft – when they could be launched at all – had to operate in the open sea, with unfortunate results to their frail structures...’⁴⁰ The selection of a site for a seaplane station on the Tyne and the ultimately unsuccessful choice of South Shields illustrated the various elements needed for seaplane operation. Squadron Commander Rathbone from RNAS Redcar, reported on possible sites on Tyneside in September 1915: ‘...there is no suitable site... except to the south of the mouth of the Tyne... This is the only site on this coast which had the advantage of a considerable stretch of enclosed water to be used for landing and getting off in rough water.’⁴¹ Admiral Ballard, the Admiral of Patrols, strongly disagreed with this assessment: ‘...I do not consider it possible to construct a seaplane station at the mouth of the Tyne... A very heavy sea breaks all along the South Jetty on to the Herd Sand in the easterly gales... no slipway could be built that would be strong enough to withstand it unless constructed of stone...’⁴² Despite Ballard’s objections the station at South Shields was built and was largely unsuccessful; Rear Admiral Commanding, East Coast of England reported in June 1917 that except at high tide it was not possible to launch seaplanes from the slipway and local weather conditions with fog and heavy swell were wholly unsuited to seaplane requirements.⁴³ South Shields was closed much to the relief of Christopher Bilney, a seaplane pilot, presented a bleak tableau of life there: ‘The harbour was generally

³⁸ Minute by Naval Assistant to DAS, 16 July 1917, AIR 1/667/17/122/752.

³⁹ Minute by DOD, 19 July 1917, AIR 1/667/17/122/752.

⁴⁰ G.E. Livock, *To the Ends of the Air* (London: HMSO, 1973), pp.39-41.

⁴¹ Letter by Squadron Commander, RNAS Redcar to Admiral of Patrols, Immingham, 11 Sep 1915, AIR 1/632/17/122/72.

⁴² Letter by Admiral of Patrols, Immingham to Secretary of the Admiralty, 15 Sep 1915, AIR 1/632/17/122/72.

⁴³ Letter from Rear Admiral Commanding East Coast of England to Secretary of Admiralty, 4 Jun 1917, AIR 1/638/17/122/157.

too small for us to take off... The amenities... were completely nix [nil]... The officers lived in a little hotel, which we ran ourselves and there was nothing to do in the evening. On the main we used to run a poker or shove ha'penny pool or something of that sort to keep ourselves out of mischief.'⁴⁴

A number of seaplane stations used temporary facilities to get them operational quickly. At Fishguard in March 1917 the hangar and slipway were complete, but the aircrew were billeted in the Fishguard Bay Hotel and some ratings in Goodwick Village and railway carriages. A temporary petrol store of 1000 gallons was available in the Great Western Railway garage.⁴⁵ The seaplane station at Seaton Carew with twelve aircraft was accepted as almost wholly temporary in nature according to a Captain Vyvyan, Naval Assistant to DAS, in November 1917:

'It is not proposed to erect permanent sheds, but to use Bessoneaux [hangars], and the risk of their being blown down during the winter gales must be faced.... it is not proposed at present to erect huts, but to use the Smelting Company's hut as long as available, billeting the surplus officers and men at Seaton Carew and placing them under canvas in the spring...'⁴⁶

The introduction of the Porte and Large America flying boats in 1917 required extensive facilities limiting the stations at which they could operate:

'These [Porte] Large Boats require large sheds and heavy slipways and, at present, can only be accommodated at Killingholme and Felixstowe... No more of these machines are being built, being superceded by Large America Type... These Boats require fairly large sheds and slipways. They can be accommodated at the following Stations: Houton Bay (building). South Shields. Killingholme. Yarmouth. Grain. Calshot. Cattewater, Plymouth (building).'⁴⁷

The construction work did not hinder bringing the flying boats into service on account of the slow production of such large machines.

⁴⁴ N.H. Bilney, IWM/SA 002, Reel 2.

⁴⁵ Extract from letter by Vice Admiral, Milford Haven to Admiralty, 4 Mar 1917, AIR 1/631/17/122/45.

⁴⁶ Minute by Naval Assistant to DAS, 22 Nov 1917, AIR 1/654/17/122/506.

⁴⁷ Minute by Commodore Paine for DAS, 30 January 1917, AIR 1/658/17/122/594.

Airships stations

The requirement for a network of airship stations was not one that could have been foreseen before Admiral Fisher, the First Sea Lord, called for a series of non-rigid airships to counter the U-boat threat in February 1915. On the outbreak of war there were only two airship stations at Farnborough and Kingsnorth; rigger Eustace Evans was appointed to Kingsnorth in November 1914 and recalled his first task: ‘...the transporting of wooden sectional buildings which were to be erected for the additional officer accommodation... The weather was simply atrocious and the continuous rain turned the ground into deep sticky mud...’⁴⁸

Midshipman Victor Goddard was in the battleship HMS *Britannia* in May 1915, when he was one of a dozen promising young officers summoned to the Admiralty by Fisher to be airship pilots. Goddard’s initial balloon training was in Roehampton and his quarters presented a stark contrast to those on *Britannia* at Scapa Flow:

‘Grove House... in Roehampton Lane was evidently a very rich man’s house... complete with the staff of butler and servants... Roehampton, which was beautifully appointed and luxurious to a degree, to sleep in comfortable beds and have meals of first-class cuisine, offered to you by liveried servants, was quite something quite spoiling and of course we, as young midshipmen, enjoyed this kind of style of life very much indeed.’⁴⁹

Fisher held a conference on 19 June when it was decided to open six bases for non-rigid airships and two for rigids.⁵⁰ Two months later facilities were well advanced at Dover, Polegate, Luce Bay, Anglesey, Marquise in France and Larne in Ireland. Two portable airship sheds had been sent to the Dardanelles. Work had just begun at the Lizard and Pembroke and further bases were planned at Aberdeen, Firth of Forth and the Humber. The most advanced station was Dover, which possessed two sheds for five SS airships. At Polegate two sheds, each for three airships were nearing completion, although there were few other facilities: ‘This Station consists of little else than the Sheds themselves, the necessary financial approval to complete the Station having been long delayed.’⁵¹

⁴⁸ E.E.H. Evans, IWM/Doc 74/139/1, 3-4.

⁴⁹ V. Goddard, IWM/SA 303, Reel 2.

⁵⁰ Minutes of conference held by First Sea Lord, 19 Jun 1915, AIR 1/2635.

Non-rigid bases at Land’s End, Selsea, Tyne, Humber, Fifth of Forth and between Peterhead and Aberdeen. Rigid bases on the Humber and in Norfolk.

⁵¹ ‘Statement re Progress with S.S. Airship Programme’ by DAD, 20 Aug 1915, AIR 1/2634.

By January 1916 there were seven stations in Britain and one at Imbros in the Aegean; these included the rigid airship construction shed at Barrow-in-Furness, non-rigid construction facilities at Kingsnorth and Wormwood Scrubs plus non-rigid stations at Anglesey, Folkestone, Luce Bay and Polgate. Thomas Williams, an airship pilot arrived at Kingsnorth in June 1916 after training at Wormwood Scrubs:

‘...it was just about finished. There were huts and buildings all over the place. Thinking back now, it was a very efficient station indeed. There were two large sheds and... I remember distinctly thinking Kingsnorth was a rise in status and conditions generally. At [Wormwood] Scrubs we were not resident but at Kingsnorth we felt we were going aboard a battleship...’⁵²

At the beginning of 1917 there were fourteen operational bases in Britain plus three rigid construction sheds at Barrow, Inchinnan and Barlow and non-rigid facilities at Kingsnorth and Wormwood Scrubs. In the Mediterranean bases were at Mudros and Kassandra and St. Pol in France. The geographical coverage of the stations in Britain was increased with bases at East Fortune in Scotland and Mullion in Cornwall. Air Mechanic Ernest Hancock arrived at Mullion in early 1916:

‘...Mullion airship station was just a field and the erection of the main airship sheds and roads was in the course of being dealt with and for the first month or two we were nothing but labourers... We had to build the first shed...’⁵³

Frederick Verry, was an SS airship pilot based at Mullion and its associated landing grounds in 1918: ‘Mullion itself was a well-equipped station with two large sheds, a gas plant and workshops which were quite well equipped for maintenance of the ships. The sub-stations were rather primitive places; there were no sheds available and the ships were moored in secluded woods.’⁵⁴

By January 1918 additional rigid airship construction facilities were available at Barking, Bedford, Flookburgh and Kingsnorth, but there was opposition to the rigid programme in October 1917 from Churchill, then Minister of Munitions:

⁵² T.B. Williams, IWM/SA 313, Reel 1.

⁵³ E.W. Hancock, IWM/SA 8950, Reel 1.

⁵⁴ F.W. Verry, IWM/SA 311, Reel 6.

‘...the Airships Programme which is dependent on the new building and housing sheds cannot mature effectively till 1919... meanwhile the erection of these sheds will hamper and impair the execution of the far more urgent Aeroplane Programme required for the spring and summer of 1918 by withdrawing both skilled labour and materials... We run a great risk of spending labour and steel in 1917 and 1918 upon the erection of sheds for airship construction which when 1919 comes will be discarded in favour of far more urgent needs of aeroplane warfare.’⁵⁵

Commodore Paine, the Fifth Sea Lord, defended the airship programme, but in doing so addressed the question of resources for the airships themselves rather than the sheds: ‘... less than 350 tons of Aluminium is required to complete the whole of the additional Rigid Airships proposed... the skilled labour required in building Airships is mostly supplied from female labour.’⁵⁶ The major construction effort, which Churchill alluded to, was for the sheds, which for rigid airships are estimated to have consumed the equivalent steel to six destroyers. Second Lieutenant J.S Middleton based at Longside between May and September 1916 gave an impression of the size of a rigid airship station:

‘It was a steel and corrugated iron shed... that was 1000 feet long and about 200 feet high... The station itself was very, very extensive... tremendous acreage because it was designed specifically for the rigids, which were much larger, and you had to manoeuvre them on the ground according to the wind so it was a very much larger...’⁵⁷

The largest sheds at Howden and Pulham, were built to house the ‘33’ Class, Howden No.2 being 750ft long, 300ft wide and 130ft high.⁵⁸ The result of suspending the construction of sheds for rigid airships would have halted construction of the airships themselves and hence was vigorously contested by the Admiralty.

Kite balloon stations

Admirals Jellicoe and Beatty frequently pressed the Admiralty for kite balloon trials with the Grand Fleet from mid-1915. In July 1916 Jellicoe complained that trials had been halted because of the need for more permanent facilities: ‘The type of hangar, wood

⁵⁵ Note by Minister of Munitions, 11 Oct 1917, Doc.No.185, in Roskill, *Documents Relating*, 532.

⁵⁶ Additional note by Fifth Sea Lord, Doc. No.185, in Roskill, *Documents Relating*, 532.

⁵⁷ J.S Middleton, IWM/SA 38, Reel 3.

covered with canvas, as originally supplied to Scapa Air Station, is not considered suitable, owing to the strong winds prevalent in this part of the country.'⁵⁹ Two months later Jellicoe estimated that facilities for twelve balloons would be needed and approval was quickly forthcoming: 'It is proposed to erect portable sheds – Silicol plant – hutting for 16 officers and 100 men at Scapa and 8 officers and 68 men at Rosyth...'⁶⁰ According to the Director of Works the first shed was due for delivery on the 3 November and the last in December.⁶¹ Estimates for 1917 were for seven sheds, thirty electric and eleven hydraulic winches, fifteen gas plants, two gas holders and five air compressors.⁶²

By July 1917 twenty-five kite balloons were allocated to Scapa, Rosyth, Shotley, Lowestoft, Sheerness, Plymouth and Milford for use with the fleet. A further thirty full-sized balloons and twenty-four dummy balloons were needed to equip convoys for anti-submarine observation and these were to be based at Portsmouth, Shotley, Devonport, Scillies, Queenstown, Lough Swilly, Immingham and on the Tyne.⁶³

Overseas - France

The largest concentration of naval air power abroad was at Dunkirk, but being close to RNAS bases in Britain was largely an essentially a part of the home organisation operating in tandem with the air station at Dover for naval operations in the Channel. By the autumn of 1915 Dunkirk was well equipped with aircraft repair workshops and accommodation for stores and Wing Commander Lambe, CO, requested further facilities to meet operational needs:

'...to obtain a maximum of efficiency, not more than twenty-four Pilots can operate from one landing-ground... in order to prepare for a vigorous Aeroplane offensive policy in the early spring of 1916, arrangements may be made for taking over and preparing two aerodromes between Dunkirk and Bergues...'⁶⁴

⁵⁸ C.E.S. Mowthorpe, *Battlebags: British Airships of the First World War, An Illustrated History* (Stroud: Sutton Publishing, 1995), Appendix C, 177-181.

⁵⁹ Letter from C-in-C Grand Fleet to Secretary of Admiralty, 13 July 1916, AIR 1/636/17/122/131.

⁶⁰ Minute by DAS, 10/1916, AIR 1/636/17/122/130.

⁶¹ Minute by Director of Works, 30 Oct 1916, AIR 1/636/17/122/130.

⁶² Kite balloon estimates for 1917, Dec 1916, AIR 1/636/17/122/131.

⁶³ Minute by Fisher, DASD, 18 Jul 1917, AIR 1/669/17/122/782.

⁶⁴ Letter from Senior Officer, RNAS Dover to Vice Admiral, Dover Patrol, 16 Nov 1915, AIR 1/629/17/120/13.

Dunkirk's complement grew from fifty-one aeroplanes and six seaplanes in September 1915 to 249 aeroplanes and thirty-seven seaplanes in April 1917.⁶⁵ The deployment to Luxeuil in northern France in the summer of 1916, which was also substantial peaking at over 100 aeroplanes in January 1917, was delayed by the transfer of the aeroplanes to the RFC rather than any lack of facilities.⁶⁶

Overseas - Mediterranean

The concept of supporting aircraft without extensive base facilities was illustrated by the seaplane carrier HMS *Ark Royal* in the Dardenelles in 1915: '... a large hold in which are at present stowed six seaplanes and four land machines [aeroplanes]. There is a well-equipped workshop for their maintenance and repair.'⁶⁷ Another innovation was the deployment of kite balloons in *Hector* and *Menelaus*. The airfield for the aeroplanes of Commodore Samson's No.3 Wing was initially on the island of Tenedos, but later moved nearer to the Gallipoli peninsula to Imbros where conditions were satisfactory according to pilot Donald Bremner:

'We were really comfortable. We had a stone-built mess room, which was the gun-room and the next door was the wardroom. We all ate in the wardroom. We lived in aeroplane packing cases... I suppose they were about ten feet long, perhaps seven feet high, and possibly seven feet wide...'⁶⁸

With the end of the Dardenelles campaign small aeroplane stations were established on Thasos, Stavros and Mitylene to support Allied forces at Salonika and a squadron of seaplane carriers was based in the Eastern Mediterranean, but the build up of forces in the theatre was slow, demonstrated by the example of Malta. The Admiralty Superintendent, Malta, requested airship and seaplane stations in January 1916 and Rear-Admiral Vaughan-Lee, D.A.S., largely supported the request:

'This [seaplane base] will be of value in any case for training purposes in the future... We happen however to have in stock sheds for two Coastals... they have the advantage of a steady platform and would probably be of more use in the

⁶⁵ Naval Intelligence Division, Admiralty, *War Vessels and Aircraft (British and Foreign), Monthly Return, Sep 1915*, NHB; First Lord's RNAS fortnightly returns, 1-15 Apr 1915, AIR 1/150/15/113/1.

⁶⁶ First Lord's RNAS fortnightly returns, 15-28 Feb 1915, AIR 1/150/15/113/1.

⁶⁷ Particulars of HMS *Ark Royal*, 1915, Doc. No.66, in Roskill, *Documents Relating*, 202.

⁶⁸ D. Bremner, IWM/SA 4, Reel 4.

clear waters of the Mediterranean than elsewhere and be a deterrent to submarines.⁶⁹

However the Admiralty Board disagreed and only the seaplane station was approved to be equipped initially five Large America flying boats, rising to ten machines at a later date.⁷⁰ In the spring of 1917 the need to increase airship anti-submarine patrols in the Mediterranean was apparent and Commodore Sueter, SAC, proposed the construction of two sheds for S.S. airships and two for Coastals at Malta, but resources were restricted and approval was only given for a single Coastal shed with local labour and materials.⁷¹ By April 1917 RNAS units were widely spread throughout the Mediterranean: there were squadrons of aeroplanes at Thasos, Mityleini, Imbros, Stavros with the repair workshops and gunnery and flying schools at Mudros. Seaplane units at Thasos, Suda Bay, Mudros with airship stations at Kassandra and Mudros.⁷²

In 1918 the RNAS forces in the Mediterranean were organised into five administrative areas; Malta, Italian, Aegean, Port Said and Gibraltar. At Malta a large extension to the seaplane station was required for the erection and repair of Large America flying boats and to accommodate reserve aircraft. Malta would become the central depot for distribution throughout Mediterranean and aerodromes in Southern Italy.⁷³ Additional requirements were for aerodromes in the Italian area at Taranto and Otranto.⁷⁴ The seaplane base at Port Said, which had previously supported the seaplane carrier squadron, was to be replaced by an airfield with a squadron of DH9 aeroplanes because of the narrow and congested harbour which restricted operations.

The relatively limited nature of the RNAS's expansion in the Mediterranean is illustrated by the number of aircraft involved, in March 1918 by far the largest concentration was 105 aeroplanes, mainly second line machines, and thirty-four seaplanes at Mudros and associated bases in the Aegean, compared with an overall RNAS first line strength of 1100 aeroplanes and 550 seaplanes.⁷⁵

⁶⁹ Minute by DAS, 29 Jan 1916, AIR 1/650/17/122/427.

⁷⁰ Message from First Sea Lord to Admiral Superintendent, Malta, 18 Mar 1916, AIR 1/650/17/122/427.

⁷¹ Minute by DAS, Apr 1917, AIR 1/649/17/122/415.

⁷² Report from VA, EMS to Secretary of Admiralty, 18 Apr 1917, AIR 1/649/17/122/408.

⁷³ Minute by DAD, 16 Feb 1918, AIR 1/1/649/17/122/408.

⁷⁴ Report by Wing Commander Longmore, 19 Jan 1918, AIR 1/649/17/122/408.

⁷⁵ Naval Intelligence Division, Admiralty, *War Vessels and Aircraft (British and Foreign), Monthly Return, March 1918*, NHB.

Inter-war years

In addition to providing the maintenance personnel and four air stations in Britain for the FAA, agreement was reached at a meeting held on 5 August 1938 that the RAF would supply aircraft repair facilities for the next three years:

‘...there should be no difficulty in providing that the RAF should carry out repairs for Fleet Air Arm aircraft on an agency basis until the new Central Repair Establishment had been constructed and was ready to function, i.e. about March, 1941, during which time the Admiralty would build up a repair organisation.’⁷⁶

This decision was as important as the loan of maintenance personnel for squadrons given the limited repair capabilities afloat: ‘...the experience of the R.A.F... has proved that there are considerable difficulties in the maintenance of the Initial Equipment (or first-line) aircraft on board ship, apart from routine servicing, minor inspections, and very minor repairs.’⁷⁷ Carriers would undertake minor inspections and repairs, but when an aircraft was due for a 120-hour, 240-hour or 360-hour inspection it would be exchanged for one in the immediate reserve and handed over to the base workshop organisation for overhaul. When either the airframe or engine became due for a major overhaul, the aircraft would be returned to an RAF repair depot until the Central Repair Establishment was completed in 1941. The RAF also undertook to repair aircraft overseas until naval facilities were available. The co-ordination of maintenance at overseas stations was identified as one of crucial importance: ‘...on the more important stations from the Fleet Air Arm point of view, the Commander-in-Chief should have on his staff a Fleet Air Arm technical officer...’⁷⁸ While the FAA had no alternative but to rely on the RAF, this would be a problem, especially on overseas stations where the facilities were extremely limited.

The navy assumed responsibility for naval air stores and equipment with the Admiralty taking over the depot at Coventry on 1 May 1939.⁷⁹

⁷⁶ Memorandum on ‘Proposed Repair and Maintenance Organisation for Fleet Air Arm aircraft’ by Technical Assistant to Fifth Sea Lord, September 1938, ADM 1/9727.

⁷⁷ Ibid.

⁷⁸ Ibid.

The Second World War

UK planning, 1938-1942

In October 1938 Duff Cooper, the First Lord, reminded Sir Thomas Inskip, the Minister for Co-ordination of Defence, of the need for the shore-based organisation to run in parallel with the carrier programme:

‘We are now building or completing five new Aircraft Carriers and a sixth is about to be ordered. It is, therefore, most necessary that we should proceed at once with our shore base organisation for the large number of squadrons which are required. In addition, we shall, in future, have a greatly increased training requirement and much of this can only be carried out from shore bases.’⁸⁰

The Naval Air Department laid out the two primary purposes for shore stations; firstly, the training for all observers and air gunners and for pilots torpedo-bombing, deck-landing, seaplane, catapult, night flying and air fighting training and secondly, continued operational training of formed squadrons. With pilots’ flying training the responsibility of the RAF, the Navy required schools for Observers and Air Gunners, a Torpedo School, a Fighter School plus facilities for seaplane, catapult and deck-landing training.⁸¹ Nor was it merely a task of replicating the training facilities which had been utilised by the RAF:

‘...the amount of training realised in the past [less than fifty hours a year per aircraft] has been insufficient to bring the Fleet Air Arm to an overall efficiency commensurate with its cost and importance... besides the embarked training, 150 to 200 hours training... must be obtained from shore bases in order to ensure reasonable all-round efficiency in the fleet aircraft during peace-time....’⁸²

In 1939 seven aerodromes were estimated to be required to accommodate thirty squadrons in wartime and Ford, Lee-on-Solent, Donibristle and Worthy Down were to be transferred from the RAF as apart of the agreement to establish the FAA. It was hoped to obtain RAF Thorney Island for use as a Torpedo School, loan Eastleigh as an Air Gunners’ and Fighter School and construct a new aerodrome in the Orkneys. As was often the case during the war the FAA was not happy with some of its allocated RAF stations; Donibristle was viewed as unsatisfactory as an operational station, but in the long-term would be a repair

⁷⁹ Notes of conference held by Director of Equipment at the Air Ministry, 5 Oct 1938, ADM 1/9718.

⁸⁰ Minute from First Lord to Minister for Co-ordination for Defence, 17 Oct 1938, ADM 116/4038.

⁸¹ Memorandum N.A.D. 512/38 from Naval Air Department, Oct 1938, ADM 116/4038.

depot while Worthy Down was only deemed suitable as an Air Gunners' School as long as slow aircraft types were in service.⁸³

For 1942 the number of units requiring shore facilities in Britain was estimated at forty-three at ten stations. Either Crail or Kilrenny were needed to replace Donibristle in its operational role and three new bases constructed for an Air Gunners' School, a Fighter School and a third for deck landing training, one of these to replace Eastleigh. An Armament Training Station was required for transfer from the RAF.⁸⁴ The Head of Air Branch estimated in January 1939 that in 1942 the FAA would have a strength of 8,700 plus some 800 trainees.⁸⁵ In April 1939, one month before the Navy regained control of the FAA, the Treasury was informed of the inadequate Air Ministry assistance:

‘The expansion of the Fleet Air Arm to something like three times its present first line strength, and provision of reserves, inevitably call for a large increase in shore accommodation. The Air Ministry are unable to transfer to the Admiralty sufficient shore stations to meet it or to do so by using stations on a shared basis, and it is necessary for us to make up the deficiency.’⁸⁶

The core requirement was to develop five new six squadron stations by 1942. After negotiations the Head of Air Branch reported the agreement for Admiralty funding: ‘The Treasury Representatives agreed that the Admiralty had established a case for three new Stations at Home to accommodate 6 Squadrons each, and for the enlargement of Lee to accommodate 7½ Squadrons, Ford to 6 Squadrons and Worthy Down to 4 Squadrons.’⁸⁷

The procedure of commissioning new air stations was something for which the RN had not been responsible for since the First World War and with Arbroath, Yeovilton, Crail and St Merryn due to commission in the first half of 1940, Rear Admiral Naval Air Stations (RANAS) drew up a schedule: ‘In order that the process of commissioning... shall be carried out smoothly and efficiently it is considered that the appointment of the Executive Officer, Paymaster Commander and the Captain's Secretary should be well in advance of any nucleus staff and not less than 3 months before the date of commissioning.’⁸⁸ Other officers and ratings would begin to arrive up to eight weeks before commissioning. This

⁸² Ibid.

⁸³ Ibid.

⁸⁴ Ibid.

⁸⁵ Minute by Head of Air Branch, 26 Jan 1939, ADM 116/4038.

⁸⁶ Letter from Head of Air Branch to T.L. Rowan, Treasury, 6 April 1939, ADM 116/4038.

⁸⁷ Minute by Head of Air Branch, 24 Apr 1939, ADM 116/4039.

⁸⁸ Letter from RANAS to Secretary of the Admiralty, 17 Feb 1940, ADM 1/13596B.

arrangement did not become official Admiralty policy and was revisited three years later as the Head of Air Branch noted in April 1943:

‘When... Arbroath, Yeovilton, Crail and St Merryn were nearing completion early in 1940, arrangements were made to appoint certain officers and to draft nucleus parties of ratings to these Stations at suitable periods in advance of the dates of commissioning, in order that the process of commissioning might be carried out smoothly and efficiently. Since then a number of other Stations in the United Kingdom have been brought into use, but of late no fixed procedure for commissioning has been followed.’⁸⁹

An Air Branch Acquaint of 1 May 1943 approved a commissioning procedure for new stations with a nucleus party arriving between three and four months before the commissioning date. DNAO and DACR would open an Admiralty paper six months beforehand laying down the commissioning date of each station, its functions and squadron requirements.⁹⁰

Some stations transferred from the RAF required considerable work on their facilities as observer Charles Friend discovered on arrival at RNAS Ford in the autumn of 1939:

‘I and the rest of the 36th Course were dismayed to be accommodated in bell tents, that station not having yet been provided with enough huts... It was a bit much... to join the Navy and be made to live in a tent at the edge of an aerodrome! The winter of 1939/1940 was bitterly cold and snowy, and inhabiting a tent and changing into flying clothing in a very draughty hangar was not exactly paradise.’⁹¹

The war dislocated training with the Observer School at RNAS Ford being extensively bombed in 1940. This led to the commissioning of RNAS Piarco in Trinidad, but the problems of training overseas were graphically demonstrated when the first course sent out, No.43, was lost when the liner *Arandora Star* was torpedoed in the Atlantic on 2 July 1940. Desmond Wilkey, one of the trainees in No.44 course recalled the situation when they arrived: ‘...by the time we got there they were very anxious to get some [observers] trained so they truncated our course a bit... They even took about six of our most promising

⁸⁹ Minute by Head of Air Branch, 16 Apr 1943, ADM 1/13596B.

⁹⁰ Air Branch Acquaint, 1 May 1943, ADM 1/13596B.

recruits early out of the course to bring them back to England to man squadrons.⁹² The advantages of Piarco included ample sea room for navigational exercises, good sea conditions and excellent all year round flying weather.⁹³ Not only was the aerodrome operated by Pan American Airways available, but the Governor offered local labour to build the accommodation for 150 Officers, 170 Chief Petty Officer and Petty Officers and 730 ratings.⁹⁴ Lieutenant Ronald Gellatly was posted to Piarco to train observers and undertake anti-submarine patrols in April 1942:

‘The huts were the same for both ratings and officers, except that the officers were split into small cabins. At the end of each hut were lavatories and shower baths. Wash basins and jugs were in each cabin. There were much larger wooden huts at each end of the camp for officers and other ranks messes. Near these each had a small swimming pool and tennis courts.’⁹⁵

Those sent to Piarco were fortunate not to have endure the surroundings at Arbroath, the other Observer Training School, like Air Mechanic George Aymes in the winter of 1940:

‘The living area was constantly under water... and there were more people in the camp than would normally be accepted... but conditions were not conducive to healthy living... there was an epidemic of cerebrospinal meningitis ... There were actually forty of us who went down with it and... only two of us survived.’⁹⁶

Anthony Corkhill, pilot of the Walrus aircraft of HMS *Devonshire* was appointed to RNAS Hatston in the Orkneys in January 1940 and endured a similar experience: ‘... oh dear, it was still only partially built. We lived in wooden huts. We had wooden benches on which one would normally sit at a table, but no tables. We sat astride wooden benches to eat and we had no doors and no windows... it was a sea of mud in Orcadian gales...’⁹⁷ Hatston had commissioned on 2 October 1939, but when completed there were few better air stations for training, especially during the summer and early autumn, as pilot George Sadler of 835 Squadron recalled June 1942:

⁹¹ C. Friend, IWM/Doc 86/37/1, 13.

⁹² D.G.J. Wilkey, IWM/SA 14150, Reel 1.

⁹³ Minute by Anstice for DNAD, 26 Jul 1940, ADM 116/4176.

⁹⁴ Minute by Head of Air Branch, 30 Aug 1940, ADM 116/4176.

⁹⁵ R.S. Gellatly, IWM/Doc P13, 85.

⁹⁶ G.A. Aymes, IWM/SA 16355, Reel 2.

⁹⁷ A.D. Corkhill, IWM/SA 14157, Reel 1.

‘...The days were long.... The airfield with lush green grass had runways but ninety feet wide, different from most air stations... Considering that the station was something of an outpost, it was quite well appointed. The wardroom had one unusual feature – the best stocked bar I experienced in the whole of my service.’⁹⁸

By August 1941 there were twelve air stations in Britain including the headquarters at RNAS Lee-on-Solent and a core of training establishments such as the Fighter School at Yeovilton, the Air Gunners’ School at Worthy Down, the Torpedo School at Crail, the Armament Training Squadron at St Merryn plus Observers’ Training School No.2, and Deck Landing Training School at Arbroath. Eastleigh was used to accommodate squadrons forming and Donibristle, Machrihanish, Hatston and Twatt for disembarked squadrons.⁹⁹

One of the easiest ways to increase the capacity of a station was to assign a satellite aerodrome to provide another runway and accommodate spare aircraft. Captain Moody, DNAD, recommended satellites for Arbroath, Crail and Yeovilton in January 1941, but admitted: ‘...since the Navy started late in the hunt for aerodromes, there is little likelihood of sites being found near Naval Air Stations that would be suitable for use as a satellite for night flying...’¹⁰⁰ A site at Zeals was earmarked for Yeovilton, but this was requisitioned by the RAF and other locations were not likely to be so suitable: ‘The remaining sites all suffer from the usual disadvantage of this area of England, i.e. that to get a level space it is necessary to go to the low lying parts, where the ground is unserviceable for four months of the year...’¹⁰¹ Satellites for Yeovilton were opened at Haldon in August 1941 and Charlton Hawthorne in January 1943 and Henstridge in April 1943 when Haldon was reduced to a care and maintenance basis.¹⁰²

In November 1941, DNAD laid down a requirement for six new stations, but half of this programme had to be deferred at the end of the year. To meet the remaining requirement Burscough and Ronaldsway were requested in August 1942 and Crimond in September. By the end of August 1942 the only new major bases were Fearn for four disembarked squadrons and Stretton for two disembarked squadrons.¹⁰³ 835 Squadron arrived at Stretton on 22 September: ‘Unlike its beautiful winged namesake, it was a rather dark and depressing corner of industrial England near Warrington. Accommodation was

⁹⁸ Sadler, *Swordfish Patrol*, 40.

⁹⁹ Statement of Air Stations and Air Sections at RAF Sections in United Kingdom by Air Branch, 14 Aug 1941, ADM 1/13603.

¹⁰⁰ Minute by DNAD, 11 Jan 1941, ADM 1/13594.

¹⁰¹ Letter from CO, RNAS Yeovilton to RANAS, 30 Jan 1941, ADM 1/13594.

¹⁰² Ben Warlow, *Shore Establishments of the Royal Navy: Being a list of the Static Ships and Establishments of the Royal Navy*, 2nd ed (Liskeard: Maritime Books, 2000), 72.

¹⁰³ Report ‘R.N. Air Establishments at Home and Overseas’ by Air Branch, 24 Aug 1942, ADM 1/13603.

poor, consisting mainly of Nissen huts which were uncomfortable and inadequately heated... all in all, it was an undistinguished and unmemorable experience.'¹⁰⁴ Unsurprisingly the most palatial surroundings were found at Lee-on-Solent and pilot George Sadler was based there in May 1942: 'Daedalus was the Fleet Air Arm HQ, the most prestigious of the naval air stations with splendid accommodation and facilities. Unlike many other stations it was not situated miles from civilisation...'¹⁰⁵

Many air stations were located near the coast to fulfil their naval roles and pilot Anthony Corkhill, 819 Squadron, was pleased to be seconded to Coastal Command for four months in 1942: 'They were very happy months for the simple reason that we were ashore in the summer at RAF airfields that were near civilised towns, which was a very strange thing to happen to one in the Fleet Air Arm because we had no Naval Air Stations anywhere near civilisation.'¹⁰⁶ RNAS Machrihanish was a classic example located on the shores of the Clyde primarily to accommodate disembarked squadrons and 835 Squadron was based there in October 1942:

'...[it was] not a very happy ship, partly due to the transient nature of its visitors (it was called the Clapham Junction of the FAA) and partly due to a very exacting regime of night flying training often in difficult weather conditions and surrounding hills which led to the loss of a number of crews. It was also very isolated which made any leave under a week's duration hardly worth taking.'¹⁰⁷

The experience of RNAS Fearn illustrates the time lag between a station commissioning, becoming operational and building up to full capacity. Commander S.B. de Courcy-Ireland, joined as Commanding Officer in September 1942:

'...[Fearn] commissioned officially on 1st August 1942; by which time the Ship's Company had increased to four Officers, 2 P.O's [Petty Officers] and 30 ratings. They were still outnumbered by the Defence Force!... the officers lived on No.2 site and the Ship's Company on No.1 site, both a quarter of a mile from the Mess huts. There was no water, no drainage and no sanitation... There was a Lieut Commander Flying and no aircraft, a Torpedo Officer but no Torpedo Section or torpedoes.'¹⁰⁸

¹⁰⁴ E.E. Barringer, IWM/Doc 91/17/1, 64.

¹⁰⁵ George Sadler, *Swordfish Patrol*, 35.

¹⁰⁶ A.D. Corkhill, IWM/SA 14157, Reel 4.

¹⁰⁷ E.E. Barringer, IWM/Doc 91/17/1, 66.

¹⁰⁸ S.B. de Courcy-Ireland, IWM/Doc 92/4/1, 301.

825 Squadron was the first to arrive in October 1942 when the hangars and control tower still under construction. By the summer of 1943 there were 1500 personnel including 200 Wrens who assumed numerous roles: 'The Wrens took over more and more men's work, cooks, stewards, regulating, aircraft fitters, torpedo maintenance, writers, drivers and so on...' ¹⁰⁹ The station continued to grow until it accommodated 3000 personnel in the spring of 1944.

Naval Air Expansion Programmes and UK airfield requirements, 1942-1945

From October 1942 until May 1945 the requirements for naval air stations in Britain can be directly linked to the Naval Air Expansion Programmes discussed in Chapter 2. ¹¹⁰ Air Branch Memorandum A.01479/42 of 14 October 1942 formed the basis of air station expansion from 1942-1946. The requirement for air stations was reviewed in an Air Branch memorandum of 3 December 1942, at a meeting on 10 March 1943 and in Air Branch memoranda on 23 June 1943, 25 January 1944 and 10 May 1945. ¹¹¹

In a letter to the Under Secretary of State, Air Ministry, on 10 October 1942 the Head of Air Branch reported the vastly different circumstances caused by the surge in American carrier production:

'...plans for increasing the strength of the Fleet Air Arm are largely governed by the rate at which new aircraft carriers can be brought into service... In recent months it has been found possible to plan for a greatly increased number of carriers over the next three years, the majority of which are to be provided by the conversion of American merchant ships. This has necessitated a... consequent expansion of the requirements for shore facilities for Naval air squadrons in the United Kingdom. It would be quite impossible for the Admiralty to meet these latter requirements without the cooperation and assistance of the Air Ministry.' ¹¹²

The point was also made that due an insufficient number of airfields the problem of overcrowding was becoming acute with First Line squadrons housed at training establishments leading to large complements such as 195 aircraft at Arbroath, 192 at Donibristle, 169 at Yeovilton and 151 at Worthy Down. ¹¹³

¹⁰⁹ Ibid, 304.

¹¹⁰ For full details of the state of naval air stations in the UK in August 1942 prior to the October expansion programme see Appendix 1.

¹¹¹ Memoranda A.01757/42, 3 Dec 1942; A.0401/43, 23 June 1943; A.02335/43, 25 Jan 1944; A.0630/45, 10 May 1945. All memoranda and minutes of meeting in ADM 116/5321.

¹¹² Letter from Head of Air Branch to USS, Air Ministry 10 Oct 1942. ADM 116/5321.

¹¹³ Ibid.

Out of the twenty-two requirements specified in October 1942, nine were earmarked for 1943, seven for 1944, three in 1945 and another three with no specified date. The facilities for 1943 included an Air Gunner School and a station for working up squadrons in Canada, an Observer School in Britain, one TBR and two fighter stations in the Irish Sea area, and two Receipt and Despatch Units (RDUs), one near Liverpool and one near the Clyde.¹¹⁴ By December 1942 Burscough had been identified as a site for one of the fighter stations in the Irish Sea area, a site at Crimond as the new Observers' School while the civil airport at Ronaldway in the Isle of Man was a possibility for the TBR station. The Air Gunners' School was up and running at Halifax in Nova Scotia. However, the Canadian Government had refused the Admiralty's request for more facilities for working up squadrons on the basis that it was outside what had been agreed in the Ottawa Training Agreement.¹¹⁵ This serious omission in the programme was filled by the USN with increased facilities at Quonset and the temporary loan of Eglinton and Maydown in Northern Ireland from the RAF.¹¹⁶

Both the Canadians and Americans made substantial facilities available for pilot training releasing bases in Britain for more advanced training and disembarked squadrons. Pilot John Ough was at No.14 Service Flying Training School at Kingston, Ontario in the autumn of 1944: 'We were at once impressed by the airport's size, its triangle of twin runways and, most of all by the large numbers of awe-inspiring, formidable-looking Harvard aircraft...'¹¹⁷ The best USN facilities were placed at the FAA's disposal and pilot Norman Hanson was one of the first to experience American hospitality at Pensacola:

'Our party was the second to arrive... To the US Navy, Pensacola was known as "the Annapolis of the Air". Sixteen thousand men, together with a great number of families in married quarters, were stationed there... The living quarters were luxurious by British standards of that time. We lived eight to a room in spacious, well-equipped dormitories...'¹¹⁸

In the plans of December 1942 thirty-three squadrons were earmarked to form or rearm in the USA leaving forty single-seater squadrons to be formed elsewhere between April 1943

¹¹⁴ Memorandum by A.H.M. Irwin for Head of Air Branch, 14 Oct 1942, ADM 116/5321.

¹¹⁵ Message from Canadian High Commission to Dominions Office, 10 Jan 1943, ADM 1/13512.

¹¹⁶ Memorandum attached to Admiralty letter, 3 Dec 1942, ADM 116/5321.

¹¹⁷ John Ough, *Crumbs!* (Burnstown: General Store Publishing House, 1999), 99.

¹¹⁸ Norman Hanson, *Carrier Pilot: An Unforgettable True Story of Wartime Flying* (Cambridge: Patrick Stephens, 1979), 26.

and October 1944. With working up taking four months and rearming lasting two months, accommodation was needed for ten squadrons simultaneously.¹¹⁹

After the Canadian decision a request to the USN was made for extra facilities for working up: ‘...a further seventeen squadrons of nine aircraft each. If agreement could be obtained this would result in all Corsair squadrons being formed in U.S.A.’¹²⁰ This agreement left eight Avenger and fifteen Martlet squadrons to be formed in UK which were covered by the loaning of Eglinton and Maydown from the RAF. In all thirty-six squadrons totalling 800 Officers, 6000 ratings and 600 aircraft were formed in the USA and 2100 pilots trained under the Towers Scheme, named after Admiral John Towers USN, between 1941-1945.

Shore facilities were also needed for one-third of embarked and Alternative Armament squadrons. Dreyer noted that the prospect of meeting requirements was hampered by the government ban on new construction projects:

‘...it will be necessary to obtain financial approval for each new Station in turn. The situation is further complicated by the existing ban on works’ proposals at home, which at the date of this report [13 January 1943], has the effect of suspending the letting of contracts for the new Naval Observer School at Crimond and also for the new Fighter Station at Burscough, both of which are vital to the implementation of the expansion programme.’¹²¹

F.A. Whitaker, Civil Engineer-in-Chief, commented that delays in the programme were endemic: ‘...in every case, the estimated completion dates were much later than those required by the approved programme, the delays varying between three and nine months.’¹²² Captain Renwick, Deputy Director of Air Material, pointed out the need to complete existing stations: ‘...in the event of there actually being any surplus labour it would be employed on works which are already in hand but not completed owing to shortage of labour, eg. the Orkney airfields.’¹²³

The Head of Air Branch concluded in February 1943 that the major problem was the time for airfield construction and the amount of prior warning this required:

¹¹⁹ Message from Dominions Office to Canadian High Commission, 15 Dec 1942; Minute by Head of Air Branch, 2 Feb 1943, ADM 1/13512.

¹²⁰ Minute by Head of Air Branch, 2 Feb 1943, ADM 1/13512.

¹²¹ Report by CNAS, 13 Jan 1943, ADM 1/13484.

¹²² Minute by C.E-in-C., 15 Jan 1943, ADM 116/5321.

¹²³ Minute by Deputy DAM, 21 Jan 1943, ADM 116/5321.

‘It appears necessary therefore to state normal requirements some 2 to 3 years before they are needed. Requirements for aircrew training have to be ready for use some 15 months before the actual First Line expansion takes place in order that the crews may be trained. In case of training stations therefore, the requirement must be raised nearly 4 years before the actual First Line expansion takes place.’¹²⁴

Given a four-year period for the procurement process to come to fruition and the lack of pre-war planning the possibility of the FAA achieving its targets for airfields appeared non-existent without RAF assistance. However, the situation was made worse because airfields were not given the same priority in the expansion programme as the other elements:

‘Approval for our requirements cannot, at present, be obtained until they can be justified up to the hilt in terms of ships, aircraft and personnel known to be forthcoming. Since these items can be, and are, produced in a matter of months under current conditions, it follows that our air stations will inevitably be out of phase with the rest of our expansion and will lag far behind.’¹²⁵

In addition to a perceived lack of priority within Admiralty planning there had been much discontent at the assignment of air stations from the Air Ministry. The Aerodrome Board was responsible for identifying possible sites suitable for development into air stations. Captain Moore, Assistant DNAD, reported in October 1942 that the situation was improving: ‘The Aerodrome Board now give D.A.M. every assistance subject to the limitation that sites already found can be offered to Royal Navy by Air Ministry permission...’¹²⁶ However, Captain Bridge, DNAO, reported in February 1943 on the number of poor sites offered to the Admiralty by the Air Ministry and Aerodrome Board: ‘...much valuable time been spent in eliminating useless sites and satellite stations which (for several obvious reasons) were not required by the R.A.F.’¹²⁷ What was needed was a bi-service organisation to identify possible sites in the first instance as Captain Renwick, DACR, observed: ‘...This difficulty cannot be obviated until all potential airfield sites throughout the world are held in pool for development by whichever Service has the greatest need at the time.’¹²⁸

¹²⁴ Minute by Head of Air Branch, 10 Feb 1943, ADM 116/5321.

¹²⁵ Ibid.

¹²⁶ Minute by Assistant DNAD, 15 Oct 1942, ADM 1/13493.

¹²⁷ Minute by DNAO, 18 Feb 1943, ADM 116/5321.

¹²⁸ Paper by DACR, 24 May 1943, ADM 116/5321.

At an Admiralty meeting on 10 March 1943, six months after the initial statement of requirements, delays were evident on several projects. The Observers' School at Crimond, required by September 1943 was not expected for completion until January 1944. The fighter station at Burscough, earmarked for September 1943 would not be fully operational until May 1944 and the TBR station at Ronaldsway would be ten months late in July 1944. The second fighter station, based at the former RAF Angle, would be operational with half its proposed capacity by July 1943, its original completion date. On the other hand some of the 1944 projects would come on line early thanks to a juggling of resources; both the fighter school at RNAS Henstridge and the new Torpedo School at RNAS Fearn scheduled for April 1944 would be in business in July 1943.¹²⁹

F.A. Whitaker, Civil Engineer-in-Chief, blamed the delays at Burscough on the lack of constructional labour: 'The contracts for the construction of Burscough have been placed... Unfortunately, the indication is that labour will not be forthcoming in the next few months in the quantity and quality required.'¹³⁰ The First Lord informed the Secretary of State for Air that Air Ministry help was essential: 'The building situation is now so difficult that we shall be quite unable to provide the shore facilities needed for the expansion of the Fleet Air Arm in 1943 and 1944, unless you can see your way to help us still further by transferring several more suitable RAF stations.'¹³¹ Archibald Sinclair replied that two airfields would be transferred and three loaned including Eglinton and Maydown to cover the shortfall left by the refusal for facilities in Canada. These would bring the total to fourteen transferred to the FAA, three on loan and FAA units based at ten more.¹³²

Such apparent generosity cut little ice among the Admiralty Departments including Captain Renwick, DACR: '...the Admiralty's claims to airfield sites do not receive a satisfactory priority and, consequently, the general position is that the Admiralty can only claim such sites as the Air Ministry do not require.'¹³³ He was fully supported by Captain Bridge, DNAO: '...our requirements to provide shore accommodation and training facilities for Carriers' Squadrons available in 1944 cannot possibly be met by now searching for almost non-existent, suitably situated construction sites.'¹³⁴ Out of the sites which had been offered only Grimsetter was entirely acceptable. Eglinton and Maydown whilst entirely welcome were only on loan until May 1944 and Angle and Abbotsinch were

¹²⁹ Report of meeting on 'Air Expansion Programme in U.K', 10 Mar 1943, ADM 116/5321.

¹³⁰ Minute by C.E-in-C., 27 Feb 1943, ADM 116/5321.

¹³¹ Letter from First Lord to Secretary of State for Air, 15 Mar 1943, ADM 1/14905.

¹³² Letter from Secretary of State for Air to First Lord, 6 Apr 1943, ADM 1/14905.

¹³³ Minute by DACR, 12 Apr 1943, ADM 1/13493.

of doubtful value: '...Abbotsinch is a very doubtful asset altogether; but we shall have to make the best of them, at any rate for the present.'¹³⁵

In early May 1943 there was some relief with the announcement that the proposed Alternative Armament squadrons announced in Naval Air Expansion Programme of 1942 would not be formed until 1945.¹³⁶ Captain Moore, the Assistant Director of Plans (Air), proposed on 3 May that the Admiralty should plan for the next two years within its own resources:

'It is quite possible to build our own additional requirements in time for 1945 if we get down to it now. We have a clear opening to do so since the Air Ministry have said that they cannot do any more for us. There is no longer any reason why we should be led up the garden path... by the Air Ministry.'¹³⁷

Therefore he proposed the request should be limited to Eglinton and Maydown only. If no further sites were available for transfer, nine new air stations would have to be built by December 1945. These requirements could be offset if the loan of Eglinton and Maydown were renewed beyond October 1944 and if facilities in the USA for working up, equivalent to three stations, were retained. Out of the remaining four sites, two sites were provisionally earmarked, but difficulties were foreseen in obtaining stations near Liverpool and on the Clyde with torpedo and air firing ranges for the autumn of 1945.¹³⁸

The revision in memorandum A.401/43 on 26 June 1943 listed urgent new requirements as the construction of a new station for a Naval Operational Training Unit (NOTU) and the School of Air Combat. The expansion of RAF Abbotsinch, transferred to the FAA, and RNAS St Merryn, the latter to take Air Gunners' and Fighter Schools' Air Firing Units, were also needed. To meet requirements in December 1944, RAF Grimsetter would be handed to the Navy with an additional capacity of twenty-four aircraft and RNAS Stretton expanded. A site for a new fighter station near Stretton would have to be found. Requirements for 1945 comprised a new TBR station in January on the Clyde, a new fighter station near Liverpool by April and a new station near the Clyde or Scapa Flow by June with facilities for fighters and TBRs.¹³⁹

¹³⁴ Minute by DNAO, 14 Apr 1943, ADM 116/5321.

¹³⁵ Minute by DNAO, 15 Apr 1943, ADM 1/13493.

¹³⁶ Paper by AD of P (A), 2 May 1943, ADM 116/5321.

¹³⁷ Minute by AD of P (A), 3 May 1943, ADM 116/5321.

¹³⁸ Minute by Head of Air Branch, 17 Jun 1943, ADM 1/13493.

¹³⁹ Memorandum by Irwin for Head of Air Branch, 23 Jun 1943, ADM 116/5321.

One of the difficulties in relying on the Air Ministry was the possible change of facilities available. The Admiralty Board approved the use of RAF Angle as a Fighter Direction Centre on 16 June 1943, but received a letter from the Air Ministry eight days later offering RAF Dale instead as Angle was needed for flying boats involved in anti-submarine operations.¹⁴⁰ Similarly in early July a request was received to exchange RNAS St Merryn in Cornwall for RAF Talbenny in Pembrokeshire, to accommodate Coastal Command units for anti-submarine operations in Bay of Biscay. RANAS vigorously opposed the move since St Merryn was the only naval Air Gunnery School and any transfer would cause training to be halted completely for up to three months.¹⁴¹ In fact the RAF withdrew its request a few days later.

Despite complaints over lack of resources it is not clear to what extent there was an actual shortage of manpower; F.A. Whitaker, Civil-Engineer-in-Chief suggested in early 1943 that labour was sufficient: '...the labour force allotted to the Admiralty in February is 8.1% of the building labour in the country (the Fleet Air Arm share is 1.3%); any contribution made by using existing RAF Stations will be relatively small.'¹⁴² There certainly seems to have been some debate over whether the Admiralty had enough labour and if it was using it properly according to Head of Air Branch five months later: '...the Admiralty labour force for the current period has been only 31,000, as against a theoretical allocation of 38,000, may be in part due to our inability to use our labour, but in some measure it must be attributable to the Ministry of Labour's inability to give it to us.'¹⁴³

One of the most significant changes in airfield requirements occurred in December 1943 when in line with the Admiralty decision to organise the FAA in Wings and Carrier Air Groups, rather than individual squadrons, it was decided that it was no longer appropriate to continue the policy of dispersing squadrons, but that resources should be concentrated at established bases.¹⁴⁴ These new requirements called for the expansion of Burscough, Fearn, Twatt and Machrihanish to accommodate Carrier Air Groups each with a capacity of seven squadrons of ninety-two aircraft plus other units, which in the case of Machrihanish meant a total of 174 aircraft.¹⁴⁵

Burscough had only been accepted because of a lack of other suitable sites and except for Fearn and Machrihanish, it was the only station capable of expansion. It was not ideal because of poor weather conditions in Lancashire which had a serious impact on

¹⁴⁰ Minute by DNAO, 15 July 1943, ADM 1/13590.

¹⁴¹ Report from R.A.N.A.S. to Secretary of Admiralty, 12 July 1943, ADM 1/13590.

¹⁴² Minute by C.E-in-C., 27 Feb 1943, ADM 116/5321.

¹⁴³ Minute by Head of Air Branch, 29 Jul 1943, ADM 1/13648.

¹⁴⁴ Minute by G.C.B. Dodds for Head of Air Branch, 10 Dec 1943, ADM 116/5321.

training schedules. Burscough's poor weather and facilities combined to give it a pretty notorious reputation as observer instructor Gordon Wallace remembered in 1944:

'There seemed to be mud everywhere and short wellies became the rig of the day... Our living quarters was the ubiquitous Nissen hut... To go to the bathroom you had to venture out partly dressed into the elements with the wind blowing up into one's nether regions. Most of us developed severe colds and the evenings often found me in the sick bay inhaling Friar's Balsam under a towel.'¹⁴⁶

Owing to difficulties in getting approval for construction work in mid-1944, the expansion of Burscough would have to be a long-term objective. A similar experience occurred over Culdrose: '...no works construction [has] yet commenced... considerable financial objections will be raised to this proposal for construction of a new Station at this stage of the war.'¹⁴⁷

In December 1944 the proposed expansion of Burscough and a new station at Penston on the Firth of Forth were abandoned due to the large scale reduction in planned first line strength.¹⁴⁸ Just as the decision to introduce Carrier Air Groups had a major impact on requirements, the reduction in the long-term First Line expansion programme in the autumn of 1944 from 2689 aircraft to 1605 removed a number of difficulties including the envisaged deficiency of facilities for 130 First Line aircraft by January 1946.¹⁴⁹ An Air Branch's memorandum on 10 May 1945 postponed the expansion of Fearn, Inskip and Twatt with only the work at Machrihanish to continue. In addition labour difficulties meant that little progress was made on the other new requirements and given government policy this was unlikely to change: '...the long period required for construction because of continued labour difficulties make it certain that major airfield works begun now would be of use for only a very limited period... the trend of Government policy is towards using the country's works labour and materials for housing and other reconstruction schemes...'¹⁵⁰

Despite the reduction of First Line commitments in the long term immediate requirements in 1944-1945 actually rose: '...our total requirements for airfields have in fact increased during the past year because of the increased training commitments arising from

¹⁴⁵ Ibid.

¹⁴⁶ Gordon Wallace, *Carrier Observer: A Back Seat Aviator's Story* (Shrewsbury: Airlife Publishing, 1993), 186.

¹⁴⁷ Minute by DNAO, 12 May 1944, ADM 1/16478.

¹⁴⁸ Minute by Head of Air Branch, 15 Dec 1944, ADM 1/16478.

¹⁴⁹ Minute by DNAO, 14 Aug 1944, ADM 1/16478.

¹⁵⁰ Memorandum by G.C.B. Dodds for Head of Air Branch, 10 May 1945, ADM 116/5321.

technical developments, the greater complexity of air warfare and other causes.’¹⁵¹ Accordingly a number of RAF stations would be transferred by June 1945 for duties not foreseen in January 1944; these included RAF Drem for a Night Fighter School, RAF Peplow for an Instrument Flying School, RAF Woodvale for a Liverpool FRU, RAF Macmeery for a Rosyth FRU and RAF Ballyherbert and RAF Nutts Corner for Fighter Schools while RAF Locking was needed for a RN Artificers Training Establishment and RAF Warton as an Aircraft Repair Yard. A new TBR School was needed in Scotland to replace RNAS Crail, which was not suitable for larger types of aircraft entering service.¹⁵²

Repair Yards

In addition to stations for training and disembarked operational squadrons, facilities were needed for aircraft maintenance and repair and the first consideration was to support the Fleet at Scapa Flow. In May 1939 the Admiralty approved more repair capacity at Evanton: ‘...for use immediately on the outbreak of war, the facilities for 120 hour inspections and minor repairs of Fleet aircraft in ships at Scapa. These facilities will be about 50% of those which will eventually be available at Hatston.’¹⁵³ Despite such planning the RAF was expected to remain responsible for major repairs to FAA aircraft for a considerable period:

‘...major repairs and overhauls of Fleet Air Arm aircraft, including, in the case of first line squadrons, 120 hour inspections, will remain with the Air Ministry until such time as a naval repair organisation has been built up... Present indications are that it will not be possible for the Admiralty to assume this responsibility before about April, 1941.’¹⁵⁴

It is indicative of the pre-war situation that while the Navy was getting facilities for minor repairs into operation these were largely manned by RAF personnel.

The primary repair depot in Britain was planned for Bedenham near Gosport. Vice Admiral Preece, Civil Engineer-in-Chief concluded that this was the most suitable site as it had easy access by rail and sea and was near both Gosport airfield and Portsmouth

¹⁵¹ Ibid.

¹⁵² Ibid.

¹⁵³ Letter from Secretary of Admiralty to C-in-C Home Fleet, 17 May 1939, ADM 1/9896.

¹⁵⁴ Ibid.

dockyard.¹⁵⁵ The Fifth Sea Lord was concerned that if Bedenham did not proceed then considerable increases were necessary in aircraft production:

‘...the only alternatives left to us are either to go ahead forthwith the original Bedenham scheme or else place orders to give production of something like 45 additional airframes and 30 engines a month to make good the anticipated deficiencies in the Fleet Air Arm for lack of repair and maintenance, involving an annual expense in the region of £4 million. Apart from the expense this would be a large additional strain on the productive capacity of the country.’¹⁵⁶

This statement perfectly illustrates the often ignored relationship between aircraft repair and production. The success and failure of FAA aircraft production programmes are widely analysed, but the capacity of repair depots to maintain those aircraft in service has rarely been given attention. The difficulty of simultaneously planning for the long term and meeting short term commitments under wartime conditions was soon apparent with the Bedenham scheme. Originally construction was planned to take two years and the establishment manned by civilian labour to undertake all inspections, overhauls and modifications for first and second line squadrons in Britain. In February 1940 it was decided that the priority must go to establishing limited facilities at the earliest opportunity and to build an Aircraft Repair Shop and a half size Engine Repair Shop, which should be operational in December 1940.¹⁵⁷

The facility at Bedenham became known as Fleetlands, which still exists today as a facility of the Defence Aviation Repair Agency. Despite being the FAA’s main repair facility there was a crisis over the shortage of labour at the end of 1943 and the Admiralty successfully appealed to the Ministry of Labour: ‘...the Admiralty’s demand for labour at Fleetlands has been given super preference and arrangements have been made for the intake of 60 skilled and 180 unskilled workers.’¹⁵⁸ It’s long term future was emphasised by Rear-Admiral Bedale, DAMR: ‘As Fleetlands is permanent and as there should, as soon as Germany is defeated, be little difficulty in providing labour to man it, it would seem to be a short sighted policy not to make every effort to man it in the meantime.’¹⁵⁹ The FAA faced a constant battle to remind the relevant ministries that the peak of its effort would be against Japan rather than Germany.

¹⁵⁵ Minute by C.E-in-C., 17 Feb 1939, ADM 116/4039.

¹⁵⁶ Minute by Fifth Sea Lord, 9 Nov 1939, ADM 116/4039.

¹⁵⁷ Minute by Head of Air Branch 14 February 1940, ADM 116/4039.

¹⁵⁸ Minute by Head of Air Branch, 20 Dec 1943, ADM 1/15511.

¹⁵⁹ Ibid.

Air Store Depots

Another forgotten element of air logistics was the air store depots to support the air stations and repair depots. They came low down on the list of priorities and at the start of the war construction of bespoke depots was sacrificed to concentrate resources on the construction of air stations. Two depots were established in requisitioned storage at Coventry and Woolston near Southampton.¹⁶⁰ The need for a third depot was identified in 1940 and a site at Almondbank in Scotland identified in early 1941. Its construction was made more urgent by the fate of the original depots: ‘...proposals for providing it were being pursued when heavy air attacks destroyed more than half of the Woolston storage and practically all the storage at Coventry, with large quantities of valuable stocks.’¹⁶¹ The depot at Almondbank, near Perth, would be based on the example of an RAF Maintenance Unit with 200,000 square feet of storage space, 10,000 feet of workshops and accommodation for 100 staff. To save time and cost it was proposed to use ten Bellman hangars, which were surplus to requirements to provide storage space.

With the large-scale expansion plans announced in the autumn of 1942 this was never going to be enough and E.S. Wood, the Director of Stores, confirmed on 30 July 1943 an additional 340,000 square feet at Almondbank and new depot of 300,000 square feet in South Wales at Llangannech due for completion by 30 June and 31 March 1944 respectively. The size of air store depots on 1 July 1944 would be 600,000 square feet at Almondbank, 430,000 at Stafford, 300,000 at Llangennech and 120,000 at Copenacre. The choice of Llangennech was determined by the availability of labour rather than its geographical suitability.¹⁶²

The expansion of air store capacity was directly related to the aircraft expansion programmes which envisaged an increase in the first line from 875 in January 1943 to 2464 in January 1946 and 2685 at end of 1946. For the total aircraft strength of 1887 on 1 July 1943, 810,000 square feet of storage space was required, rising to 1,450,000 for 3035 aircraft on 1 July 1944 and 1,900,000 for 4242 aircraft on 1 January 1946. To meet the increase between 1944-1946 another 200,000 square feet each at Almondbank and Llangennech and 50,000 square feet in the Midlands. Once again the choice was determined by the labour question:

¹⁶⁰ Minute by Fifth Sea Lord, 21 Oct 1943, ADM 1/15382.

¹⁶¹ Admiralty Memorandum No.1140 for Treasury Inter-Service Committee, 3 Feb 1941, ADM 1/11852.

¹⁶² Memorandum by Director of Stores, 30 Jul 1943, ADM 1/15382.

‘...it is clear that the major requirement for air stores will continue to be in Scotland. It is out of the question, in view of staffing difficulties, to contemplate setting up another Depot in Scotland... the proposed expansion in South Wales... will make Llangennech a more economically worked unit from the staffing point of view.’¹⁶³

It was not only the increased number of aircraft which affected the air stores requirement but also their size and complexity as J.H. Hearn of the Air Store Department noted in September 1943:

‘American type spares present a new and considerable problem; and the major spares for new British types, e.g., Barracuda, are taking up nearly twice the space required for older types. Everything is bigger. Previously all our propellers in stock (not many) were cased. Now they come in stands and they must be given covered storage.’¹⁶⁴

In October 1943 the Air Store Department had to deal with 140,000 different items rising to 160,000 when all the types of American aircraft were in service. The extension at Llangennech was approved in December 1943 and that at Almondbank in May 1944. It would be mid-1945 at the earliest before these facilities would be available and adequate storage guaranteed.¹⁶⁵

Overseas planning, 1939-1942

The establishment of base requirements overseas in the Second World War differed from those for training and disembarked squadrons in Britain, Canada and America because they were dictated by changing strategic and operational requirements, rather than the overall Air Expansion Programmes as carriers could be deployed to any theatre.

A comprehensive memorandum by Captain Larcom, DNAD, in May 1939 laid out the Overseas Base Requirements of the FAA for 1940 and 1942.¹⁶⁶ The Defence Requirements Committee had set 1942 as the limit to which plans could be made. Larcom’s primary purpose was to raise the issue of which organisations were responsible for the FAA’s shore facilities for consideration by the Committee of Imperial Defence. The only

¹⁶³ Ibid.

¹⁶⁴ Letter from J.H. Hearn, Naval Store Department to G.C.B. Dodds, Air Branch, 14 Sep 1943, ADM 1/15382.

¹⁶⁵ Minute by Director of Stores, 29 Oct 1943, ADM 1/13582.

¹⁶⁶ Memorandum on ‘FAA Overseas Base Requirements, 1942’ by DNAD, 5 May 1939, ADM 116/4664.

facilities in the interwar period constructed purely for use by the FAA, although manned by RAF personnel, were at Bermuda and Simonstown.¹⁶⁷ The remainder were shared with RAF squadrons.¹⁶⁸ All air bases were under administrative and operational control of the RAF. Existing facilities were wholly inadequate for war requirements given the small peacetime forces they had been expected to support. In the Far East for example, *Hermes* and *Eagle* were the mainstay of the China Station between 1925 – 1939 with one usually on station. *Eagle* carried only twenty-four aircraft and *Hermes* a mere twelve.

The Air Division's plans were based on four types of administrative arrangement. Some existing airfields were to be transferred from the RAF to Naval control¹⁶⁹ while other RAF facilities were to remain shared by the two Services.¹⁷⁰ Certain Civil Aerodromes, to be taken under military control, were also to be shared¹⁷¹ and small naval detachments – air sections – were to be deployed at selected RAF and RCAF stations.¹⁷²

The overseas requirements will be analysed according to bases for trade routes, which could be largely predicted from the outbreak of war and those for the Far East which grew into an enormous undertaking that were far easier to plan on paper than to put into effect. Nor was there a total reliance on static air stations through the use of maintenance shipping and mobile air facilities.

Requirements for trade routes

In addition to existing facilities on trade routes at Bermuda and Simonstown, the Admiralty applied to Treasury Inter-Service Committee on 27 March 1940 for approval for aerodromes at Gibraltar, Dakar, Halifax and Kingston, Jamaica. At RCAF Dartmouth, Halifax, the Canadians agreed to provide the necessary labour and materials to carry out the works for \$190,000.¹⁷³ Dartmouth was a classic example of a base being built before carriers were available to use it and the Commanding Officer, HMS Canada, of which Dartmouth was one unit, reported in October 1942 that it was a waste of resources:

‘While I am necessarily ignorant of our naval air policy, as also of our materiel resources for implementing it, I remain altogether astonished that after over three years of war, such admirable resources as exist at Dartmouth in space, equipment

¹⁶⁷ Minute by Head of Air Branch, 9 Jun 1939, ADM 116/4664.

¹⁶⁸ Gibraltar; Halfar, Luca and Marsa Xlokk, Malta; Canal Zone, Egypt; Simonstown, South Africa; Trincomalee, Ceylon; Sembawang, Singapore; Hong Kong; New Zealand.

¹⁶⁹ Gibraltar; Halfar and Luca, Malta; Sembawang, Singapore; Bermuda.

¹⁷⁰ Marsa Xlokk, Malta; Canal Zone, Egypt; Trincomalee, Ceylon; Hong Kong.

¹⁷¹ Alexandria, Egypt; Singapore Civil Aerodrome; Freetown.

¹⁷² Aden; Halifax and Vancouver, Canada.

¹⁷³ Memorandum by Air Branch, 8 May 1940, ADM 1/13510.

and skilled labour should be employed to so little purpose, and be, for lengthy periods, to all intents and purposes, lying fallow.¹⁷⁴

The Naval Air Expansion Programmes envisaged large numbers of CVEs and MAC ships coming into service, but these were not due until 1943. When those ships did come into service more resources were needed at Dartmouth as Air Branch signalled in August 1944: 'In addition to those requirements laid down in November 1943, there was a need for three disembarked MAC ship flights of twelve aircraft plus three spare MAC flying crews and six Swordfish for loan to MAC crews for flying practice with accommodation for 422 personnel.'¹⁷⁵ The CO, RNAS Dartmouth reported the vastly greater use of the station in 1944: 'A total of 106 Mac Ships for 1944, as compared with a total of 15 for 1943, was one of many increased commitments which had to be dealt with during the past year.'¹⁷⁶

An example of the need to meet new operational requirements at short notice was the request by C-in-C Western Approaches for facilities in Iceland in March 1943: 'It is anticipated two escort A/C [aircraft] carriers will be ready for operational service by 18th April. Request steps may be taken to ensure that adequate spare A/C and necessary parts, maintenance stores and ammunition may be available in Iceland and Argentina by that date.'¹⁷⁷ Aircraft were flown ashore from HMS *Archer* on 5 May with three Officers, seven Petty Officers and twenty-three ratings sent to RAF Kaldadarnes, forty-eight miles from Reykjavik. Unfortunately just two months later the RAF announced that Kaldadarnes was to close and the navy was unable to take it over as Captain Moore, Assistant Director of Plans (Air), commented: 'The trouble is that we are simply not in a position to put down "penny packets" of Naval Air Facilities all round the world.'¹⁷⁸ Co-incidentally after *Archer* delivered the aircraft and personnel no CVE's used bases on the North Atlantic trade routes for the next four months, but Admiral Horton, C-in-C Western Approaches remarked this was no indicator for the future: 'The period also coincides with the complete lull in U-Boat warfare along the northern route and cannot be taken as any criterion for the future... our actions must to a large extent be dictated by the movements of the enemy and at this juncture it is impossible to state whether or not Iceland will be used by escort carriers in the future.'¹⁷⁹

¹⁷⁴ Letter from CO, HMS Canada to Secretary of Admiralty, 17 Oct 1942, ADM 1/13512.

¹⁷⁵ Message from Head of Air Branch to CO, RNAS Dartmouth, 30 Aug 1944, ADM 116/5294.

¹⁷⁶ Report from CO, RNAS Dartmouth to Secretary of Admiralty, 7 Jan 1945, ADM 1/17392.

¹⁷⁷ Message from C-in-C, WA to Admiralty 18 Mar 1943, ADM 1/13542.

¹⁷⁸ Minute by AD of P (Air), 31 Jul 1943, ADM 1/13542.

¹⁷⁹ Message from C-in-C, WA to Admiralty, 21 Aug 1943. ADM 1/13542.

In the spring of 1944 it was decided to rationalise some units established on the outbreak of war: ‘...closing down the small Fleet Air Arm storage units (e.g. *Argentia* – *Gibraltar* – *Freetown* etc) which are expensive in manpower and material... Very little use has been made of the scattered stored reserves in the last 12 months.’¹⁸⁰ In addition the Admiralty Board agreed that CVE’s should carry a larger number of reserve aircraft and if necessary damaged aircraft [be] thrown overboard.’¹⁸¹

Expansion in the Far East

On the outbreak of war Far Eastern forces were divided between the East Indies and China Stations and the forces envisaged for 1942 make interesting reading, both because of the scale of provision and the priorities between the various fleet commands. The East Indies Station, based on Aden and Trincomalee, would support the carrier *Courageous* with twenty-four aircraft, nine seaplanes aboard *Albatross* and six cruiser-borne catapult aircraft

The major forces were allocated to the China Station centred on Sembawang airfield in Singapore and the requisitioned Singapore Civil Aerodrome. At Singapore in 1942 the navy anticipated an impressive array of carriers as at any other naval base in the world; *Ark Royal*, *Glorious*, *Indomitable*, *Implacable* and *Indefatigable* with a total capacity of 225 aircraft. Fifty-four seaplanes, twenty-four reserve aircraft and a further twenty-four ‘planes for the Fleet Requirement Unit and Target Training duties concluded this substantial complement of 327. Storage would be needed for 340 reserves, with the aircraft repair ship *Unicorn* carrying a further forty. The monthly capacity of aircraft maintenance facilities was to be ten light repairs, eighty major inspections, thirty aboard *Unicorn*, and thirty complete overhauls.’¹⁸²

However, these plans were far in the future given that air facilities in the Far East were substantially incomplete or non-existent. The main airfield at Sembawang required substantial work before being handed over to the Navy. Construction of a repair yard at the same location was essential. Meanwhile the repair of naval aircraft would continue at RAF Seletar and in lieu of the completion of Sembawang, provision for four squadrons was sought at RAF Tengah. In Hong Kong RAF Kai Tak was to be shared by the two Services, until the new RAF airfield at Pat Heung was completed when the former would be handed over for sole use by the FAA. Shared air bases at Aden and Trincomalee were for the use of East Indies forces.’¹⁸³ The FAA had no choice but to continue with the peacetime practice of

¹⁸⁰ Minute by Civil Lord, 29 Mar 1944, ADM 1/16422.

¹⁸¹ Minute from Head of Air Branch, 25 May 1944, ADM 1/16422.

¹⁸² Details of Eastern Forces from Memorandum by DNAD, 4 May 1939, ADM 116/4664.

¹⁸³ Memorandum by DNAD, 5 May 1939, ADM 116/4664.

sharing bases for the foreseeable future: ‘...the Admiralty will have to rely upon the co-operation of the Air Ministry in the provision of storage and packing and repair and maintenance facilities at these places for the next few years at any rate.’¹⁸⁴ As it turned out the FAA was dependent on some Air Ministry and RAF resources, for example the packing of aircraft for transportation overseas, right up to the end of the Second World War.

The Far East was clearly the target when in November 1937 the Admiralty Board adopted the policy: ‘...of providing Fleet Air Arm Depot Ships for servicing part of the first line aircraft and housing some of the reserves, and thus reducing the shore requirements.’¹⁸⁵ The result was *Unicorn*, a 14,750-ton aircraft maintenance depot ship, designed to maintain 100 aircraft from three Illustrious class carriers in areas of the world where shore facilities were lacking. On the basis that each aircraft flew for twenty hours a month, all 100 would require either a 120, 240 or 360 hour overhaul every month. These overhauls were estimated to take three, four or five days respectively. Accommodation was provided for thirty erected and serviceable aircraft and twelve crated spares.¹⁸⁶

The expense and complexity of *Unicorn*’s design has attracted criticism on the grounds that she was over-engineered for her role. She possessed two hangars, one equipped with an extensive range of workshops, the other for serviceable aircraft and with a full flight deck resembled a smaller version of the fleet carrier *Ark Royal*.¹⁸⁷ Such criticism is entirely unjustified. For the accommodation and repair of aircraft, areas of a large volume – hangars – were the only solution. If aircraft were to be tested for airworthiness before being flown off to the fleet carriers a flight deck was essential. The ship carried two lighters which proved extremely useful in ferrying aircraft to and from the shore or other ships. Given that when she was designed it was not known what shore facilities would be available it was logical to assume that she may have to undertake all the repair and testing herself. During Operation ‘Iceberg’ between March-May 1945, in support of the US invasion of Okinawa, this exact situation arose. No shore facilities were available on Leyte in the Philippines and sustained air operations were possible only because of *Unicorn*’s presence there acting as the forward air base. The only problem in giving her a carrier’s configuration was the tendency to press her into service as an operational carrier as happened at Salerno in September 1943.

The major problem was that while the RAF was happy to accommodate disembarked naval squadrons and repair their aircraft at Singapore in peacetime, in a war

¹⁸⁴ Minute by Head of Air Branch, 9 Jun 1939, ADM 116/4664.

¹⁸⁵ Minute by Head of Air Branch, 20 May 1939, ADM 116/4038.

¹⁸⁶ Minute by Controller, 4 Apr 1938, ADM 1/9432.

¹⁸⁷ For full technical details see Legend of Particulars, Design ‘C’ by DNC, 2 Jun 1938, ADM 1/9432.

the situation would be very different; for example rather than aircraft being overhauled at RAF Seletar, the Air Ministry advised ‘...it may be necessary for the Admiralty in war to set up a separate organisation at or near Singapore for that purpose.’¹⁸⁸ With only a small number of maintenance personnel at this time, this would have been very difficult. It was envisaged that the peacetime arrangements in Ceylon could continue, despite the increase in the number of reserve aircraft from thirty to fifty-five, major inspections from two to ten per month and overhauls from one to five. It had not been intended in peace or war that overhauls would be undertaken at Trincomalee, but in Singapore or Karachi instead.

In the early months of the war, the Commodore, Malaya, reported that the majority of RAF repair facilities at Singapore were being used by the navy ‘...the greatly increased number of Fleet Air Arm machines that have come in from ships since the war started, owing to the extra flying that has been necessary on patrols.’¹⁸⁹ The obvious difficulty would arise when the RAF began significant operations and took up the majority of the repair capacity. Then naval maintenance personnel would be required. In addition he recommended that a FAA Officer, of sufficient seniority to co-ordinate resources with the Commanders-in-Chief, should be appointed to supervise aircraft maintenance requirements.

By a remarkable co-incidence the papers of this very officer, Lieutenant-Commander C.N. Colson, appointed Naval Air Maintenance Officer, China and East Indies Station on 25 December 1939 are available in the Imperial War Museum.¹⁹⁰ Colson went on to become one of the most experienced naval air officers in the Far East serving in a series of appointments for the next six years.¹⁹¹ As well as recommending detailed improvements to facilities at the various bases, Colson disagreed with the RAF view that Singapore’s aircraft maintenance capacity could not be increased:

‘...they [RAF] consider that their facilities are not large enough to cope with FAA work as well as their own in the event of war action occurring in the areas for which they cater. With reservations I do not agree with this view. In Singapore there is a large skilled native population which supplies a large proportion of the

¹⁸⁸ Letter from Air Ministry to Admiralty, 10 Aug 1939, ADM 116/4664.

¹⁸⁹ Report ‘Administration of Fleet Air Arm Materiel at Singapore’ from Commodore Malaya to C-in-C China, 2 Dec 1939, ADM 116/4664.

¹⁹⁰ Commander C.N. Colson. IWM/Doc 78/38/1.

¹⁹¹ Colson served as Naval Air Maintenance Officer, Far East, 1941-1942; Air Engineer Officer to Commodore Naval Air Stations, Ceylon, Oct 1942 – Aug 1943; Assistant Staff Officer to Rear Admiral Naval Air Stations, Indian Ocean, Aug 1943 – Dec 1943; Superintendent Aircraft Maintenance Yard, HMS Tambaram, Dec 1943 – Jan 1945; Superintendent Aircraft Maintenance Yard, HMS Valluru, Jan – Nov 1945.

[RAF] labour force... and I suggest that steps could easily be taken to augment this force from this source.’¹⁹²

Full details of the accommodation to meet the FAA’s Far East requirements were drawn up at a joint Admiralty and Air Ministry meeting on 11 June 1940. RAF Sembawang would be transferred to the FAA to house the five disembarked squadrons of the 1940 programme, but bases outside of Singapore would be needed for the remaining five squadrons of the 1942 plan. Similarly only half of the reserves could be maintained on Singapore Island and the remainder within 400 miles. Repairs would continue to be undertaken at RAF Seletar, with a new engine repair site planned for Kuala Lumpur until the FAA’s own facilities were completed at Sembawang. At Trincomalee, facilities would continue to be shared until new RAF accommodation was ready at the end of 1942.¹⁹³

The handover of Sembawang by the Air Ministry was expected to occur in August 1941. To make it fully operational further stores buildings, workshops, torpedo facilities and bombing ranges were needed and the Air Ministry agreed to undertake this on an agency basis for completion by the handover date. Construction of the repair yard from scratch would take two and a half years.¹⁹⁴

At the same time the Fifth Sea Lord highlighted the danger of neglecting air facilities through current wartime experience: ‘The provision of storage and repair facilities for Fleet Air Arm aircraft in Singapore...has been strongly emphasised by the complete absence of such facilities for our Fleet Air Arm now operating in Egypt.’¹⁹⁵ Rear-Admiral Tom Phillips, Vice Chief of the Naval Staff and best-known for his ill-fated command of Force Z, clearly had a much firmer grasp on naval air strategy than tactics. Phillips’ minute of 1 November 1940 cut straight to the heart of the argument regarding the pivotal role of logistics in the successful deployment of air power:

‘The whole basis of our sea power rests on having adequate bases for repair facilities all the world over. It may be expensive but it is one of the things we have to pay for being a world empire. So far as our surface ships are concerned we have, in the course of generations past, slowly developed these facilities from year to year. With the coming of the air corresponding facilities for the maintenance of

¹⁹² Letter from Lt Cdr Colson to C. in C’s China and East Indies, 20 Jun 1940, IWM/Doc 78/38/1.

¹⁹³ Minutes from meeting on Fleet Air Arm Requirements held at the Air Ministry, 11 Jun 1940, ADM 1/11850.

¹⁹⁴ Notes of meeting on Naval Air Requirements in the Singapore area held by Air Materiel Dept, 9 Oct 1940, ADM 1/11850.

¹⁹⁵ Minute by Fifth Sea Lord, 31 Oct 1940, ADM 1/11850.

aircraft at all our bases abroad are just as necessary as the facilities for the maintenance of the ships. The trouble is that one generation has to face up to the whole expenditure for this provision for aircraft whereas the provision for ships has been spread over many generations.’¹⁹⁶

Phillips was extremely critical of the RAF, whose system of bases the navy had to rely on. He appeared to have a clear and farsighted appreciation of the role of logistics as a great enabler in maintaining strategic options for the planners: ‘They [the R.A.F.] are at present the least mobile of all the three Services, and when one wants to operate aircraft in any area months have to be spent getting the facilities ready.’¹⁹⁷

In mid-1941 Admiral Layton, then C-in-C East Indies, questioned the concentration of aircraft maintenance facilities in Singapore, the cornerstone of naval air policy in the Far East. Layton thought it unwise to ignore the provision of facilities in the rest of the Indian Ocean, noting that all planned operations were west of Singapore and there was an obvious paucity of facilities throughout the theatre. Dependence upon Singapore might also be a risky venture: ‘Intended facilities as laid down in Admiralty letter A.084/40 of 6/3/1940 are mainly situated in Malaya where they are vulnerable, and to and from which freight shipping is even now most inadequate.’¹⁹⁸ Colson, Layton’s Naval Air Maintenance Officer, believed the plans overlooked the fact that carrier aircraft often required shore facilities, more often than they were likely to be based at Singapore. In the foreseeable future, sharing the increasingly congested RAF facilities at Singapore was inevitable and Colson also noted the base’s susceptibility to enemy bombing.¹⁹⁹

Layton’s scheme, inspired by Colson, involved the transfer of the Eastern theatre’s main aircraft repair yard from Sembawang at Singapore to Colombo, and an increased capacity for aircraft storage and major inspections at China Bay in Ceylon. He also proposed a minor repair yard at Durban for use by the South Atlantic and Far East fleets and the transfer of facilities from Aden to Mombasa in Kenya. Given that the Admiralty was committed to Singapore, the Colombo scheme was never likely, but DNAO agreed to some repair facilities in Durban, establishing a Naval Air Section at RAF Port Reitz in Mombasa and the expansion of China Bay in Ceylon.²⁰⁰ In October 1941 the only naval air facilities in the Far East were at Aden, Ceylon and Durban. Work had not yet started at

¹⁹⁶ Minute by VCNS, 1 Nov 1940, ADM 1/11850.

¹⁹⁷ Ibid.

¹⁹⁸ Message from C-in-C East Indies to C-in-C China, 23 Jul 1941, ADM 1/22775

¹⁹⁹ Appreciation of Fleet Air Arm Maintenance, Far Eastern Theatre by Lt Cdr Colson, Naval Air Maintenance Officer, Far East to C-in-C East Indies, 21 Jun 1941, IWM/Doc 78/38/1.

Singapore; the bases at Sembawang and Port Swettenham, formerly Penang, would not be complete at least another twelve months and the repair yard at Khatib was not scheduled for completion until March 1943.²⁰¹ As a result of Layton's intervention, it was agreed that HMS *Unicorn* would be sent to Ceylon on completion in October 1942.²⁰²

With the fall of Singapore, the immediate task of supporting a fleet comprising five battleships, two aircraft carriers and a host of escorts manned by 15,000 officers and men fell on Kilindini, the port of Mombasa, in East Africa where it arrived on 7 May 1942. The first FAA personnel to arrive were 150 technical ratings who sailed into Mombasa on board HMS *Alaunia* on 3 May 1942. J.F. Drew, the Naval Store Officer at Kilindini between 1942-1945, commented on the great expansion of air facilities in his final report:

'The amount of work on the Fleet Air Arm Section at Kilindini grew very rapidly, and stores from the United Kingdom, Durban and United States of America arrived in ever increasing quantities. These were required to maintain squadrons of the Fleet, together with the major Repair Yard at Nairobi and Air Stations at Tanga, Port Reitz, Voi and Mackinnon Road... With the closing of Air Establishments in East Africa the FAA Depot completed closing down in mid '44.'²⁰³

Mackinnon Road and Voi were some fifty and ninety miles from Mombasa respectively, and Tanga in Tanganyika about seventy miles distant.

For the Eastern Fleet the campaign in the Indian Ocean can be divided into two halves. Firstly, the defensive posture assumed in 1942, the capture of Madagascar excepted, based at Kilindini. Secondly, the preparations for the offensive after Ceylon became the main fleet base in 1943. For the FAA operationally there was a simple demarcation line, since between the departure of the Fleet Carrier *Illustrious* in January 1943 and the arrival of the Escort Carrier *Battler* in October, Admiral Somerville's fleet had no carriers at all. Strategy dictated that clearing the Mediterranean was afforded top priority in 1943. Logistically, of course, there could be no such halt to the planning and preparations since the air bases, primarily in Ceylon, Southern India and South Africa, in addition to East Africa, were vital to enable a large fleet to operate in 1944 and beyond.

²⁰⁰ Summary of shore facilities existing and projected for naval aircraft on the South Atlantic Station and in the Eastern Theatre by Head of Air Branch, 15 Oct 1941, ADM 1/22775

²⁰¹ Ibid.

²⁰² Minute by Head of Air Branch, 21 Oct 1941, ADM 1/22775.

²⁰³ History of Naval Store Department, Kilindini, by Naval Store Officer, 12 Dec 1945, ADM 116/5813.

The move to Ceylon depended upon the strategic situation, progress on base facilities in Ceylon and the despatch of reinforcements for the Eastern Fleet.²⁰⁴ A significant addition to air facilities occurred in October 1942 when both the repair yard in India at Coimbatore and the air station at Katukurunda in Ceylon were commissioned. A station at Puttalam, Ceylon, was operational by February 1943. Elsewhere in the theatre further naval air stations were opened at Wingfield, formerly Capetown airport, in South Africa in July 1942 and RN Air Sections were established at South African Air Force (SAAF) Stations at Stamford Hill, Durban and Wynberg in South Africa and at Diego Suarez on Madagascar by the end of the year.²⁰⁵

At the end of 1942 Admiral James Somerville, the Commander-in-Chief of the Eastern Fleet, received a signal from the Head of Air Branch indicating the long term requirements for Naval Air Stations and shore facilities.²⁰⁶ It was necessary to accommodate two-thirds of the squadrons operating from escort carriers, one-third from fleet carriers and the alternative armament squadrons for both types.²⁰⁷ Accommodation for a total of twenty-one squadrons was necessary by the end of 1943, another eighteen by the end of 1944 and a further forty-one by mid 1945 at a total of fifteen naval air stations in South Africa, East Africa, Ceylon, Southern India, Diego Suarez, Mauritius and Aden. It should be noted that of the forty-one squadrons earmarked for 1945, thirty-five of these were provisional and their deployment was dependent on the overall strategic situation. Three Class B Repair Yards to be built initially in South Africa, Mauritius and Trincomalee which were: ‘...to service and repair ship-borne aircraft, erect and equip cased aircraft, break down damaged aircraft into serviceable components and carry out complete engine overhauls of certain types.’²⁰⁸ Air Stores Depots were planned for Durban, Kilindini and Ceylon and sufficient resources allocated to re-equip ten re-captured air stations. These proposals also called for: ‘...transportable equipment to re-equip captured bases as Fleet moves East’²⁰⁹, a forerunner of the Mobile Naval Air Bases. By 1945 four repair yards would be established in Ceylon and Southern India including the one at Coimbatore; Katukurunda and Puttalam were other possible candidates. Nine such yards were envisaged throughout the Far East.

²⁰⁴ Minute by Military Branch, 2 Dec 1942, ADM 12977.

²⁰⁵ Unpublished notes on Staff History of British Naval Aviation, 1919 – 1945, Volume III, 474, NHB.

²⁰⁶ Message 2243A from Head of Air Branch to C-in-C Eastern Fleet, 19 Dec 1942, ADM 1/12809.

²⁰⁷ Alternative Armament Squadrons were squadrons equipped with different types of aircraft from those on the carrier depending on the role it had to perform. For example a carrier could embark fighter squadrons in place of strike aircraft if it was to provide fighter cover for an amphibious landing.

²⁰⁸ Message 2242A by Head of Air Branch to C-in-C Eastern Fleet, 19 Dec 1942, ADM 1/12809.

²⁰⁹ Ibid.

The most imposing feature of this plan is the sheer size of the planned deployment and this provoked much Admiralty debate. Rear Admiral Rawlings, Assistant Chief of Naval Staff (Foreign), was concerned with apparent over provision and lack of co-operation with the RAF:

‘I hope that full regard has been given to sharing of aerodromes where possible and practicable with the RAF. I see no reason for exclusiveness on the part of either Service and I’m quite sure the tax payer will hold the same view. Thus to earmark, construct and maintain a naval aerodrome at Kilindini for Carriers, sounds an extravagance... it [the plan] is inclined to be Rolls Royce and impossible to upkeep in peacetime.’²¹⁰

Vice-Admiral Cunningham, the Fourth Sea Lord, supported Rawlings’ assessment:

‘I agree with A.C.N.S. (F) that the proposals appear to be unduly Rolls Royce... I feel that this vast problem requires greater consideration before we accept a works programme for our carriers alone seems to be far in excess of those required for the general maintenance of the Fleet as a whole.’²¹¹

The alternative view, that without air bases worldwide in the modern era, the navy would be as impotent as if it had lacked dockyards in the past and previously advocated by Vice-Admiral Phillips, was adopted by Admiral Kennedy-Purvis, the Deputy First Sea Lord:

‘While it may appear “Rolls Royce” to provide shore facilities in more than one area, this must be done unless the activities of the Fleet are to be limited to one area e.g. facilities in Kilindini are of no value to a fleet based in Ceylon and vice versa. When chain of world wide, though inadequate, facilities for ships has been built up over a period of centuries, it only natural that the requirement of similarly inadequate facilities for naval aircraft in a period of a few years should appear large.’²¹²

At the strategic level of planning it is most important for the exploration of all possible options. While to take Rawlings’ specific example, increasing facilities at Kilindini would have been wasteful given the plan to base the fleet on Ceylon, it is Kennedy-Purvis’ view,

²¹⁰ Minute by ACNS (F), 12 Dec 1942, ADM 1/13509.

²¹¹ Minute by Fourth Sea Lord, 17 Nov 1942, ADM 1/13509.

²¹² Minute by Deputy First Sea Lord, 8 Dec 1942, ADM 1/13509.

that a substantial investment in air stations was essential for navy to reap the full benefit from its large investment in air power, which holds sway with the benefit of hindsight. While new construction could be avoided where shared facilities were available and the proposals for 1945 were dependent on the unfolding strategic situation, an extensive airfield programme would be necessary in 1943-1944 to support a fleet in the Far East.

As early as the beginning of 1942 discussions even took place on possible facilities in Australia, somewhat remarkable given the paucity of facilities in the Indian Ocean. However, there were not enough air stores to supply Australia in addition to Trincomalee as Mr Carter, Deputy Director of Stores, explained:

‘...at present it would be necessary to rely on Trincomalee to send the stores where required in this area [Australia] and the question of providing an aircraft supply ship to follow the Fleet had already been discussed with Director of Stores and was now being considered...’²¹³

The Australian authorities were informed in April 1943 that unless there was great change in the war in Europe it was not anticipated that much use would be made of facilities in Australia before mid-1944. In addition there remained great uncertainty over Far East strategy:

‘Commander Pedder [Plans Directorate] explained that the reason for the delay in reaching a decision on the scale of facilities to be provided in Australia was that the joint strategy for future operations in the Far East had not yet been defined.’²¹⁴

A naval war against Japan would be rather different to one with Germany as Captain Charles Lambe, the Director of Plans, put it in June 1943: ‘...the provision of maintenance and supply facilities will present a peculiar problem.’²¹⁵ The peculiarity being that mobile facilities would be needed in addition to the permanent, larger but more distant dockyards. His solution was in line with Far Eastern naval strategy since the 1930s: ‘...we must also provide adequate mobile facilities capable of moving forward from base to base in step with the area of operations as the latter advances, i.e. they must be, as far as practicable, in the form of repair ships and auxiliaries as opposed to shore facilities.’²¹⁶

²¹³ Note of meeting held by DNAD, 6 Feb 1942, ADM 116/4727.

²¹⁴ Note of meeting held by DNAO, 22 Apr 1943, ADM 116/4727.

²¹⁵ Minute by D of P, 1 Jun 1943, ADM 1/13213.

²¹⁶ Ibid.

The first proposals earmarked Two Mobile Fleet Base Organisations (MFBO), one in the Indian Ocean and the other in the Pacific. Each would be capable of maintaining a very large fleet of four battleships, two fleet carriers, four light fleet carriers, fifteen escort carriers, fifteen cruisers, fifty destroyers and a host of smaller vessels.²¹⁷ Apart from simply being too big, the MFBO concept suffered from the same weakness as the American Lion and Cub bases, namely that it was inflexible and assumed the requirement for a base of a certain size. The main effort in the Far East was seen as the reconquest of Malaya with Pacific strategy taking a background role:

‘American resources and manpower are much greater than the British, therefore operations in the Pacific would be an American commitment, with the exception that the British Navy would provide a fleet of all classes of warship to swell the order of battle of the United States Navy... This fleet would be operating with British types of naval aircraft.’²¹⁸

Hence the logistical difficulties associated with the Indian Ocean strategy were assumed to be much greater than those in the Pacific where the Americans would provide the backbone of the logistic support. The Fourth Sea Lord agreed an overhaul of the logistic organisation was required:

‘I have felt for some time that our supply organisation, although entirely adequate when our fleet was operating from pre-established bases, was not so adequate to deal with the situation which has arisen since the move to offensive strategy with consequent necessity to operate from temporary and improvised bases.’²¹⁹

By August 1943 the proposals for mobile air units now came under the umbrella of the Mobile Naval Airfield Organisation (MNAO). This tri-service proposal for the swift occupation of captured Japanese airfields saw the Army responsible for construction and repair of air stations. They would be jointly operated by the RAF and RN as local conditions demanded. A total of ten stations were earmarked, five equipped with mobile operational equipment for quick occupation of forward airfields and the remainder with transportable equipment to follow up the advance. The operational capacity of each station

²¹⁷ Among the smaller ships were fifty escort vessels, twenty submarines and fifty amphibious ships.

²¹⁸ Memorandum on Mobility of Fleet Base Organisation by Director of Plans, 10 Jul 1943, ADM 1/13213.

²¹⁹ Minute by Fourth Sea Lord, 5 Aug 1943, ADM 13213.

was for four squadrons totalling forty-eight aircraft. Four units of Royal Marine Engineers were to be placed under operational Army control to assist with construction duties.²²⁰

When first examining at the policy for Mobile Naval Air Units (MNAUs) the Senior Officer, Mobile Naval Air Bases was less than complementary; noting that no staff requirement had been drawn up and without a clear plan the project was in danger of becoming unwieldy and unworkable:

‘A preliminary look into this subject... does more than suggest that like Topsy “It has just growed [sic]”. This form of upbringing is unlikely to produce a healthy child. It tends to rickets in youth and obesity in later years. Both are disastrous to anything whose principal aim is mobility.’²²¹

He anticipated that vehicles for the MNAUs should not need special landing facilities or shipping, they would use administrative facilities from whichever of the services was in the area and some of the carrier’s maintenance personnel might follow the squadrons ashore. These proposals were designed to make the bases as mobile and flexible as possible and avoid the situation where they would: ‘...lock up hundreds of tons of valuable technical equipment and stores, a very great number of officers and men and each one would present quite a formidable problem in sea transportation, landing and shore transport.’²²² One central base would be established, probably in southern India or Ceylon, where equipment for units could be stored accompanied by a nucleus of experienced personnel before despatching them to the front line as required. Previous proposals were based on forming the units in Britain, similar to Mobile Torpedo Maintenance Units.

The first three units had to be ready for operations by January 1945 and a further two by May. Each unit was to be equipped to service any four naval squadrons over a period of four weeks. The base was expected to be operational within two days of arrival at the site. The Air Ministry agreed that the MNAO: ‘... should be supplied as far as possible with standard RAF material and vehicles from RAF sources.’²²³ and the Army Council gave approval for it to be: ‘...equipped on Army lines and with unit equipment from War Office sources...’²²⁴ In hindsight the major Achilles heel of the proposals was the assumption of an Army presence in the theatre for construction and administrative facilities. The availability of Royal Marine Engineers to provide construction units was

²²⁰ Letter from Head of Air Branch to Air Ministry and War Office, 20 Aug 1943, ADM 1/15743.

²²¹ Survey of MNAUs by Senior Officer, Mobile Naval Air Bases, Sep 1943, ADM 1/15743.

²²² Ibid.

²²³ Letter by Air Ministry to Admiralty, 18 Jan 1944, ADM 1/15743.

also very problematic. However, this planning was crucial as in the event the only FAA shore facilities in the Pacific were several Mobile Naval Air Bases (MONABs)

As far as air logistic shipping was concerned the Joint Planning Staff put forward a provisional list of logistic shipping for the advance on Japan to the Ministry of War Transport in the autumn of 1943.²²⁵ The FAA requirement involved three groups of ships, each to maintain 250 aircraft and comprising two aircraft engine repair ships, one aircraft component repair ship and one air store issuing ship (ASIS).²²⁶ However, it was estimated that: 'Owing to the general demand on shipbuilding resources it is unlikely that the new ships entailed would be forthcoming before 1945.'²²⁷ Captain Bedale, the Director of Aircraft Maintenance and Repair, was unhappy with the progress of planning for repair and maintenance facilities and concluded that he was:

'... being forced more and more to the conclusion that the only way to be reasonably certain of meeting our [maintenance] needs will be re-introduce the Aircraft Maintenance Ship... It is not necessary, nor desirable, that these should be such fine and elaborate ships as Unicorn, in fact a slow, broad beamed hull with little sub-division and probably no flight deck, would be better.'²²⁸

Bedale was not suggesting that *Unicorn's* design had been a mistake, but that when supported by engine and component repair ships and ASIS the new aircraft maintenance ships would have to undertake a lot less work than *Unicorn* operating on her own.

Detailed consideration was given to the provision of ASIS in December 1943. Four vessels were originally thought necessary, but the Director of Stores questioned the need for so many ships because of the arrangement then in existence with the USA:

'The current agreement between the British and United States Admiralties provides for the U.S. Navy undertaking the responsibility for the provision of air stores common to both Navies, and for the storage and issue of both common and non common air stores.'²²⁹

If this undertaking was taken at face value, the only British responsibility was to supply the Americans with non-common air stores. It was the Americans' duty to distribute them. In

²²⁴ Letter by War Office to Admiralty, 13 Dec 1943, ADM 1/15743.

²²⁵ Leonard, *History of the Fleet Train*, 28-30, NHB T1884.

²²⁶ Ibid, 29.

²²⁷ Message by Head of Military Branch II to C-in-C Eastern Fleet, 30 Oct 1943, ADM 1/13301.

²²⁸ Minute by DAMR, 9 Oct 1943, ADM 116/4978.

the Horne-Patterson agreement of December 1942 the Americans agreed that as they were the power responsible for the theatre, naval, victualling and air stores common to both navies would be supplied to the RN. The Director of Stores recommended that one ship be completed as an insurance policy against the failure of the American to supply but to '...avoid giving the appearance of willingness on the part of the Admiralty to take over the U.S. supply responsibilities.'²³⁰ The Deputy Director of Aircraft Maintenance and Repair, Captain Jameson, was much less certain of the supply arrangement: 'It is considered unlikely that the U.S. Navy will be able to implement the agreement...outside the continental United States.'²³¹ After a conference on logistics held in the United States In February 1944, the Director of Stores conceded that: '...all the logistic support for the British Pacific Fleet will eventually have to provided by us.' Three ASIS would be needed to support Pacific operations with an assembly of up to 1,000 aircraft. Captain Jameson reinforced his message on the significance of their role by emphasising the impotence of the repair groups without them:

'If the A.S.I.S. cannot undertake the replenishment of the Repair Ship Groups, their mobility will be seriously impaired, especially as the ships making up the Group would be unable to continue to maintain and repair aircraft at more than a fraction of their designed capacity when on passage.'²³²

The resources of the ASIS would be expected to cover the normal maintenance demands of the operational carriers and what was termed the 'casual and urgent requirements of repair ships'. In the event of the supply system breaking down limited help may still be forthcoming from the Americans: '...the U.S. authorities have expressed the willingness to assist from their stocks and other facilities at forward bases whenever they possibly can.'²³³

By early 1944 the Ministry of War Transport urgently required a decision so it could place orders for ships from the limited merchant ship building capacity. The Director of Plans (Q) estimated the total number of first line naval aircraft for a war against Japan at 850.²³⁴ *Unicorn* would service 100 and similar to the plan from the autumn of 1943, a further three groups of ships were required for the remaining 750. The composition of each group was altered with the requirement for an aircraft maintenance ship, aircraft engine

²²⁹ Minute by Director of Stores, 19 Dec 1943, ADM 1/15727.

²³⁰ Ibid.

²³¹ Minute by DAMR, 24 Dec 1943, ADM 1/15727.

²³² Minute by DDAMR, 22 Feb 1944. ADM 1/15727.

²³³ Minute by Director of Stores, 14 Feb 1944, ADM 1/15727.

²³⁴ Minute by Director of Plans (Q), 9 Feb 1944, ADM 1/17043.

repair ship, aircraft component repair ship and air stores issuing ship. Provision of the ASIS, two of which were under construction, was not considered a problem.²³⁵

The major stumbling block was the availability of aircraft maintenance ships, requiring large internal spaces where complete aircraft could be accommodated. To adapt standard merchant ships would be too complicated and time consuming, so two half-completed Colossus Light Fleet Carriers were redesigned to perform this duty, each with had a maintenance capacity of 125 aircraft.²³⁶ *Unicorn* would perform the aircraft maintenance ship role in the third group. Three engine repair ships and two component repair ships were ordered to provide the requisite facilities for a reduced total of 750 aircraft.²³⁷ The Director of Aircraft Maintenance and Repair noted the drop in maintenance facilities afloat and forecast the need for increased provision ashore.²³⁸ The chronic shortage of shipping was illustrated by an amazing suggestion that *Argus*, the world's first flush deck carrier in 1918 and worn out by 1944, should be converted into an aircraft maintenance ship.²³⁹ Unsurprisingly, the Director of Naval Construction dismissed this concept out of hand.

The navy could not afford to wait for a firm decision about Pacific strategy and the deployment of forces in that theatre. By then it would be far too late to prepare the necessary logistic forces. Nor could it accept the advice of Admiral Ernest King during correspondence with Admiral Percy Noble, Head of the British Admiralty Delegation in Washington in January 1944:

‘...we [the Americans] do not favour dependence solely on aircraft repair ships for upkeep of carrier aircraft. Our experience convinces us that support of these facilities, to be effective, must in large degree be supplied by shore-based facilities... we are convinced that a low standard of performance would result if this system of support were not maintained.’²⁴⁰

Commander Duckworth, attached to Admiral Daniel's mission to the Pacific in the spring of 1944, also stressed the need for a balance of facilities: ‘Advanced base facilities should as far as possible be mobile and shipborne; there are however, certain facilities notably air

²³⁵ ASIS were *Fort Colville* and *Fort Langley*.

²³⁶ Aircraft maintenance ships were HMS *Perseus* and HMS *Pioneer*.

²³⁷ *Port Quebec*, the third component repair ship was already under construction.

²³⁸ Minute by DAMR, 9 Feb 1944, ADM 1/17043.

²³⁹ Minute by Head of Military Branch II, 13 Feb 1944, ADM 1/17043.

²⁴⁰ Letter from C-in-C, USN to Head of British Admiralty Delegation, Washington, 13 Jan 1944. ADM 1/16287.

which must be installed either wholly or partially on shore...'²⁴¹ While repair facilities would not be wholly afloat as King believed, the British had no provision to build air bases in the forward area, having no comparative organisation to the American Construction Battalions or 'Seabees'. In the Pacific the FAA was totally dependent upon airfields handed over by the Royal Australian Air Force or the United States Navy. Duckworth concluded that the Seabees: '...have proved the most important single factor in the rapid establishment of advanced bases and airfields without which the U.S.N. might still be in Pearl Harbor but the Japanese would probably be in Australia.'²⁴²

In spite of the logistic limitations, the discussions between the British and American Chiefs of Staff at the Sextant conference in Cairo from 22-25 November and 4-6 December 1943, primarily to consider an invasion of Western Europe and operations in the Mediterranean, also confirmed the possibility of a British fleet deploying to the Pacific the following year. Under these proposals, a force headed by a battlecruiser, two fleet and up to eight escort carriers would be operational in the Pacific by mid 1944, to be joined by the end of the year by another two battleships, two fleet, two light fleet and nine escort carriers.²⁴³ While such a Pacific deployment was unrealistic given Britain's other naval commitments and the lack of carrier availability in early 1944,²⁴⁴ it was decided to despatch a group of officers to the United States and Australia for discussions on Pacific naval air logistics.

Rear Admiral Charles Daniel, later Vice Admiral (Administration) of the British Pacific Fleet and in charge of the mission to Australia, submitted his preliminary report to the Admiralty on 10 May 1944. It had been delayed by disagreements between London and Canberra including over the mission's terms of reference.²⁴⁵ The key difference between operating in the Indian Ocean or the Pacific was the greater tonnage of shipping needed to supply a fleet in the Pacific. Churchill limited the size of a Pacific Fleet to the amount of logistic shipping that could be spared to support it.²⁴⁶

Throughout 1944 the schedule for the Pacific deployment was gradually put back as the Head of Military Branch II signalled to Admiral Somerville in mid-March: 'The British Pacific Force will not now be required to leave the Eastern Fleet at the end of March, 1944. The movement has not yet been decided upon but will probably not take place before

²⁴¹ Report on US Naval Organisation and Logistic Problems in the Central and South Pacific by Rear Admiral Daniel to Admiralty, Enclosure No.2 Paper on Advanced Base Organisation by Commander Duckworth, 3 May 1944, ADM 1/16330.

²⁴² Ibid.

²⁴³ Willmott, *Grave of a Dozen Schemes*, 44-45.

²⁴⁴ For details of fleet carriers under construction or in refit see Ibid, 59.

²⁴⁵ Willmott, *Grave of a Dozen Schemes*, 96.

August.²⁴⁷ By mid 1944 a more realistic forecast for carrier requirements in the Far East by the end of the year called for five fleet and thirteen escort carriers, although not specifying the division of forces between the two oceans.²⁴⁸ In the end whatever the strategic plans, it was the lack of logistic facilities that prevented British naval forces from entering the Pacific in 1944. As the First Sea Lord, Admiral Cunningham, explained to the Chiefs of Staff Committee in October:

‘It might be possible to arrange for participation by British units in the earlier [Philippine] operations but this could not be a sustained effort since the bases upon which the main fleet would depend were at present in American hands. It would take about two months for these to be prepared for British use after the Americans had handed them over.’²⁴⁹

Operationally the Indian Ocean remained relatively quiet for much of 1944. Between March and November the Eastern Fleet conducted periodic air strikes against Sumatra, Java and other Japanese possessions usually involving two Fleet Carriers. The CVEs *Ameer*, *Atheling*, *Begum* and *Shah* arrived in the theatre carrying supplies of reserve aircraft and were then employed on convoy escort, aircraft ferrying or anti-submarine hunting duties.²⁵⁰

In addition to supporting these operations, the facilities ashore were utilised by training squadrons preparing for the Pacific and *Ameer* became a deck-landing carrier. Ceylon became the base for aircrew training before Pacific operations. By the end of 1944 Katukurunda was the largest Royal Naval Air Station in the world and in November the Barracuda squadrons of three Fleet Carriers were re-equipped with Avengers at Ceylon without difficulty. The stage was set for the ground-breaking operations of the British Pacific Fleet which will be covered in the final chapter.

Conclusion

The commissioning of air stations by the RNAS was in tandem with the overall expansion of the service whereas the FAA struggled to get an adequate number of air stations since the carrier programme of the mid-1930s were not accompanied by matching shore facilities. Since stations for training and disembarked squadrons were needed before

²⁴⁶ Leonard, *History of the Fleet Train*, 41, NHB T1884.

²⁴⁷ Message from Head of Military Branch II to C-in-C Eastern Fleet, 17 Mar 1944, ADM 1/14837.

²⁴⁸ Minute by DNAO and DAWT, Enclosure II, 4 Jul 1944, ADM 1/16487.

²⁴⁹ Minutes by Chief of Staff Committee Meeting No.331, 7 Oct 1944, CAB 122/1095.

²⁵⁰ Unpublished notes on Staff History of British Naval Aviation, 1919 – 1945, Volume III, 520, NHB.

the squadrons to equip the carriers could become operational it was a serious flaw, although inevitable given the split of responsibilities in the inter-war era.

Whereas the large number of American CVEs was accepted on the basis that American aircraft would equip them, but the corresponding shore facilities were not guaranteed. The decision to adopt the Carrier Air Group and Wing organisations and expand existing facilities to accommodate them allowed the cancellation of some new stations, which would probably have been impossible to build. If the air expansion programme had not been curtailed in the autumn of 1944 then the FAA would have encountered real difficulties in providing enough air stations to meet it.

The RNAS had a free reign over choice of sites, but the FAA had to go through the Air Ministry's Airfield Board, which was frequently accused by the Admiralty of nominating second rate facilities. While it is clear that the FAA could not have expanded without the airfields and other resources transferred or loaned from the Air Ministry, the USN and other air forces, such great dependency caused the process to be much more difficult. At least the FAA did not have to consider pilot training facilities, which were provided by the RAF, RCAF and USN.

The RNAS's expansion occurred at fairly even pace given the introduction of new weapons into service; for example non-rigid airships in 1915 and flying boats in 1917 and there was a protracted gestation period for rigid airships, which were the most labour and materiel intensive in the provision of base facilities. The relative simplicity of aeroplanes in the era was a considerable boon as airfields with grass runways were easy to provide. The lack of airfields was not the brake on expansion for the RNAS that it was for the FAA. The number of stations operated by the RNAS in Britain depended on the operational requirements so stations for aeroplanes in the air defence role were closed and more bases opened to cover new tasks, for example for anti-submarine bases in Cornwall to cover the Western Approaches. There were only limited deployments abroad where materials and labour for construction were more difficult to obtain and they built up at a gradual pace.

The relationship between airfields and the deployment of naval air power was most clearly illustrated when considering the build up for operations Far East; there were no carriers in the theatre for a long period in 1943, but planning and construction of airfields proceeded apace and consideration given to maintenance shipping and mobile air stations for the eventual deployment in 1944. The provision of a considerable network of air stations in the Indian Ocean was one of the finest achievements of British naval aviation.

Chapter 4 – National Economics and Aircraft Production

Overview

Of all the topics discussed in this thesis, the greatest controversy has surrounded the procurement of aircraft for the FAA in the inter-war years and during the Second World War. There is little dispute that in this period British industry failed to produce the up-to-date aircraft the navy required. Quantity and quality were both sadly lacking. The large-scale expansion overwhelmed the capacity of the aircraft manufacturers to meet the demand forcing an increasing reliance upon the United States Navy at a time when the latter's air arm was also growing rapidly

It is not proposed, nor is there space, for an exhaustive account of aircraft production and readers should study Geoffrey Till's *Air Power and the Royal Navy* for a fine account of the inter-war years and Norman Friedman's *British Carrier Aviation* presents a highly detailed account of not only inter-war, but more importantly wartime production.¹ John Abbateillo's thesis 'British Naval Aviation and the Anti-Submarine Campaign, 1917-1918' is most a useful source for the First World War.²

This chapter will concentrate on certain key elements, notably the administration of aircraft procurement, which provides a vivid contrast between 1914-1916 when the navy had sole responsibility and the more complicated arrangements which existed after 1918. The Admiralty appeared capable of evaluating designs in the early years of aviation, but by 1939 the advanced aeronautical requirements, coupled with the small size of the Air Department did not allow such effective assessment. In the case of the Second World War it is also possible to compare actual production with the estimates which were drawn up as a result of the naval air expansion programmes which are outlined in Chapter 2. For the RNAS figures comparing estimated and actual production are only available for 1917-1918.

The procurement organisation was firmly established in 1939 and firms had already been earmarked as responsible for naval work; small pre-war orders meant there was little urgency to adopt mass production techniques and there was no competition for orders. While the aircraft industry was in its infancy in 1914 the Air Department was able to exploit the Admiralty's wide range of industrial contacts and utilise Britain's versatile engineering industry. The contribution of industry was a considerable factor in the success of a procurement strategy, not least the competence of manufacturing firms. The significant

¹ Till, *Air Power and the Royal Navy*, 86-110; Friedman, *British Carrier Aviation*, 155-176 and 202-217.

² J.J. Abbateillo, 'British Naval Aviation and the Anti-Submarine Campaign.' Ph.D. Diss. (King's College London, 2004), 84-95.

contributions of Shorts, Sopwith and Handley Page in the First World War are undoubted while the two major firms between 1939-1945, Fairey and Blackburn had a variable record and their products were outclassed by American designs.

The ability to develop new types of aircraft in wartime proved a considerable handicap for the FAA, long lead times being common with RAF aircraft. Progress in aeronautical design with the introduction of monoplane fighters with high-powered engines had opened a gap between the performance of FAA and land-based aircraft. The aeroplanes in use for naval roles at the end of World War I had a similar performance to land-based types. Unsurprisingly given the relative lack of technical complexity, the development time for RNAS aircraft were considerably shorter allowing the introduction of entirely new types.

First World War

Aircraft Orders and Production

A fundamental problem in assessing the relationship between aircraft orders and production is the lack of concrete figures for the latter until 1917-1918 so until that period in the war there are few benchmarks to gauge the success of the productive effort. The formation of the Air Department Progress Committee in 1917 enabled the adoption a more systematic attitude to planning.

Early in the war Churchill, the First Lord, encouraged aircraft procurement on a large scale. The major difference compared with the Second World War was that the Air Department had complete autonomy in procurement until 1916. In April 1915 he directed that there should be 1000 aeroplanes, 300 seaplanes and 400 pilots by the end of the year although there was no formal expansion programme. Commodore Sueter, the former Director of the Air Department, appeared before a meeting of the Finance Committee in October 1915 to explain the large unauthorised orders of American aircraft:

‘Commodore Sueter explained that he had ordered a very large number of machines under instructions from the late First Lord to buy all the aircraft he could lay his hands on. He also stated that an engagement had been entered into with American firms to place orders for 1,000 machines, which only 350 have so far been delivered.’³

³ Minutes of Finance Committee meeting, 28 Oct 1915, ADM 1/8433/270B.

In April 1916 Lord Curzon, Head of the Air Board, highlighted this order as an example of Admiralty extravagance: ‘...the order of 1,100 Curtiss machines in the United States at a cost of £1,750,000, only a third of which were fortunately supplied, while these turned out to be useless as war airplanes and could only be used for school work...’⁴ A revised order placed with Curtiss included the first America flying boats while the majority of the order was for 90hp Curtiss J.N.3. trainers. While these were unsuccessful at first, the modified J.N.4. was used extensively by the RNAS and RFC for training. In drawing up such an ambitious programme there was little knowledge of the ability of manufacturers to fulfil it since aviation production was in its infancy.

From 1917 it is possible to gauge the success of production compared with requirements and the following tables, compiled by the Ministry of Munitions, compare the anticipated and actual production of aeroplanes and seaplanes in 1917-1918:

Table 3. Production of aeroplanes, October 1917 – June 1918⁵

	Anticipated production	Actual production	Difference
October 1917	1465	1371	-94
November	1320	1785	+465
December	1360	1498	+138
January 1918	2097	2362	+265
February	2176	2289	+113
March	2439	2591	+152
April	2527	2121	-405
May	3127	3083	-44
June	2922	2661	-261
Total	19433	19761	+329 (+ 1.7%)

As can be seen the anticipated production rose dramatically from 1360 in December 1917 to 3127 in May 1918 and output managed to keep pace until April 1918 when a deficit of 405 was recorded.

⁴ Memorandum from Lord Privy Seal to War Committee, 16 Apr 1916, in Doc.121, Roskill, *Documents Relating*, 346.

⁵ Tables of estimated and actual output of aeroplanes, May 1917 – Jun 1918, MUN 5/212/1962 3.

Table 4. Production of seaplanes, May 1917 – June 1918 ⁶

	Anticipated production	Actual production	Difference
May 1917	75	62	-13
June	108	49	-59
July	126	86	-40
August	109	103	-6
September	116	109	-7
October	139	100	-39
November	146	158	+12
December	149	122	-27
January 1918	159	123	-36
February	145	113	-32
March	119	94	-25
April	123	78	-45
May	178	157	-21
June	173	145	-28
Total	1865	1499	-372 (-20%)

The figures for seaplanes are available over a somewhat longer period, not that this affects the overall analysis; if only October 1917 – June 1918 are included the deficit is still 18%. In October 1917 there were seventeen firms producing seaplanes and flying boats with a maximum monthly capacity of 142 aircraft, individual companies capable of producing between four and sixteen machines.⁷ The most successful type of seaplane was the Short 184, over 650 of which were built by Shorts and ten-subcontractors.

The relationship between air requirements and production is well illustrated through the example of the H12 Large America flying boats. The first fifty were ordered in the autumn of 1915, but on trials in 1916 it became apparent that the 160hp Curtiss engines were unsatisfactory and these had to be replaced with 250hp Rolls Royce ones. Due to the shortage of Rolls Royce engines the contract was not fulfilled until the autumn of 1917.⁸ In April 1917 the Director of the Operations Department laid down an establishment of 180 Large Americas in home waters for 1918. To supplement the 1915 contract, additional

⁶ Tables of estimated and actual output of seaplanes, May 1917 – Jun 1918, MUN 5/212/1960/26.

⁷ Minute from Controller of Aeronautical Supplies to Minister of Munitions, 14 Oct 1917, MUN 5/212/1962/3.

⁸ Development and Operations of the R.N.A.S. in Home Waters: Part II – Submarine Campaign, 1917-1918, 61c, AIR 1/677/21/13/1902.

orders were placed for another 331. Four months later the overall requirement including those for the North Sea barrage and the Mediterranean was 426. Given an estimated six-month service life, annual production of 850 would be needed; it was soon apparent that such a figure was impossible to achieve so the requirement was reduced to 378. Due to continuing manufacturing delays, the US Navy was approached in September to take over proposed stations in Ireland and at Brest. When agreement was reached on 19 October, requirements were limited to 234, the largest reduction from 150 to 54 being for the Northern Barrage. However, the Air Board could not even guarantee this, forecasting 170 machines by 31 May 1918, there being only 34 in service in October 1917.

At the end January 1918 orders placed 75 Felixstowe F.2a's and 100 F.3's making 506 flying boats in total. By 31 May 1918 only 105 of the 506 had been produced plus the 50 H.12's in 1917. In addition ten three-engined Porte flying boats were built in the autumn of 1917, but only two or three were fitted with engines because the Rolls Royce better utilised in Large Americas. Only nine flying boats, out of the establishment of 54 were available for northern barrage in middle of June 1918.

Administration of RNAS procurement

From the earliest days of naval aviation, the RNAS followed the standard Admiralty policy of allowing private firms to tender for contracts and this proved a better system than that of the Royal Flying Corps, which largely relied on the Royal Aircraft Factory: '...the prestige of the naval service amongst engineering firms constituted one of the advantages in providing magnetos, engines and components, which would otherwise have been very difficult to obtain... In addition, most of the firms employed on Admiralty contracts for aeroplanes were pioneer aircraft firms.'⁹ Close relationships with companies such as Shorts and Sopwith paid dividends, as they were willing to carry out experiments on the Admiralty's behalf and designed some extremely effective aircraft; Shorts became renowned for their seaplanes, Sopwith for aeroplanes and Handley Page for heavy bombers. Sopwith produced the small Schneider and Baby seaplanes for seaplane carriers in addition to the famous line of single-seater fighters, largely for use of the Western Front; the Pup entered service in September 1916, four months before the first RFC squadron was equipped with the type, the Triplane, solely in naval service, operated between February – November 1917 until replaced by the famous Camel. When the Navy required bombers in 1915 for work on the Belgian coast: '...five firms designed a machine to meet certain

⁹ Report 'Aircraft Design and Production, 1914-1918' by J.C. Nemej, 9, AIR 1/678/21/13/2186.

specified requirements. The most successful of the machines produced was the Short land machine with the 250 R.R. engine. She carried 8-112lb bombs under the wings, the only place available, and was in use in small numbers at Dunkirk for about a year, when she was superseded by the Handley Page 0/100.¹⁰

The rules of procurement are revealed in a letter to Short Bros in December 1915: 'The contractors will be given an absolutely free hand with regard to design and construction... The firms building successful machines are to agree to have their machines built by other firms either by sub-contract or by a Royalty to be fixed by the Admiralty.'¹¹ Sueter, the Superintendent of Aircraft Construction, noted in July 1916 that competition was crucial to keeping the RNAS's aircraft up-to-date:

'With the rapid advance in the development of aircraft, it is quite impossible to standardise our Machines. The Army did it with the B.E.2.C. and have failed. I have been pressed over and over again to standardize, but as you have seen, the popular machine of today may be in a few months quite outclassed. Our system has on the whole been successful. We go to several firms. They know if they do not produce a good design, other firms will get more orders. This trade competition is good and makes us quite independent of any one firm...'¹²

In 1916 the Admiralty had thirty firms building aeroplanes and seaplanes, fourteen manufacturing engines, eighteen making propellers and sixteen instrument makers. The Admiralty specified in their contracts that the firm which designed the aircraft would not have a monopoly on production and frequently sub-contracted orders. Thirty of these firms, including Shorts and Handley Page were engaged solely on naval work.¹³ Close naval relations with senior manufacturers provided a better quality product as C. Draper, Commanding Officer No.208 Squadron, recalled in 1918: 'Up to the formation of the R.A.F., the aircraft supplied by the Navy from Dunkirk were, in finish, workmanship and performance, superior to anything supplied by the R.F.C. While the R.F.C. had Camels from ten different contractors, ours were mainly of Sopwith's own manufacture.'¹⁴ The commissioning of engineers into the RNVR also enabled the manufacturers to be supervised effectively; one engineer officer was allocated to a group of up to three

¹⁰ Report 'The Development of Bombing Machines and their Bomb Gear', 1915, AIR 1/2301/215/3.

¹¹ Letter from DAS to Messrs Short Brothers, Dec 1915, ADM 1/664/17/122/705.

¹² Minute from SAC to Admiral, 3 Jul 1916, AIR 1/2642.

¹³ List of firms carrying out Admiralty contracts, 1916, ADM 1/2594.

¹⁴ C. Draper, *The Mad Major*, (Letchworth: Air Review Ltd, 1962), 83.

companies to act as the representative of the Director of Air Services.¹⁵ There were seventy-eight of these inspectors in 1916, of whom forty-three were employed at aeroplanes and seaplane manufacturers, twenty-six at engine firms, five at propeller makers and four at component and instrument companies.

In 1916 Commodore Murray Sueter, formerly the Director of the Air Department, was appointed Superintendent of Aircraft Production with four Assistant Superintendents responsible for the design, airships, production and engines plus an Armament Captain. The Design Superintendent had responsibility for seaplanes and aeroplanes, the Airship Superintendent for kite balloons and airships other than rigids, the Production Superintendent for the inspection of aircraft under construction except rigid airships, the Engines Superintendent for the design and construction of engines and the Armament Captain for armament, wireless telegraphy, electrical apparatus and gunnery training. The Director of Naval Construction remained responsible for the design and construction of rigid airships and the Engineer-in-Chief for the design of their engines.¹⁶ In November 1916 the Air Department had 300 officers and men to supervise these tasks and administer the operations of the RNAS.¹⁷

The irony of placing Sueter in charge of production was that he believed that the only dividing line between Admiralty and War Office lay in operations and that the best results could be achieved by both services working together. He wanted what he referred to as an 'Air Navy' to undertake procurement outside of Admiralty control. Sueter saw the large expansion of the service as problematic since many officers lacked the technical or scientific knowledge necessary for aeronautics.¹⁸

The procedure for placing naval aircraft orders was laid out in March 1916 for Lord Derby's Committee. The Construction Committee, presided over by the Superintendent of Aircraft Construction recommended the number and types of machines and orders to be placed. The proposals were then approved by the Director of Air Services and the Third Sea Lord before contracts were placed by the Director of Contracts.¹⁹

It was not unusual for close coordination between designers, manufacturers and users. A good example can be found in the field of non-rigid airships; RNAS officers had a

¹⁵ Report 'Aircraft Design and Production, 1914-1918' by J.C. Nerney, 9, AIR 1/678/21/13/2186.

¹⁶ Diagram of Air Department organisation and relations with Admiralty Departments and the Board, 21 May 1916, AIR 2/127 & History of Development of the Air Department, Admiralty, 1912-1916, AIR 1/674/21/6/59.

¹⁷ Draft conclusions of War Committee meetings, 27-28 Nov 1916, in Doc.151, Roskill, *Documents Relating*, 448.

¹⁸ Notes on Training, Research and Administration of an Air Navy by Commodore Sueter, 24 Jun 1916, AIR 2/163.

¹⁹ Memorandum 'Procedure in force for placing Admiralty Aircraft Contracts', May 1916, AIR 2/127.

direct input into designs working in conjunction with civilian engineers. Specifications for a simple non-rigid design were issued to private companies in 1915, but it was a team of naval engineers who came up with the design for the Submarine Scout. The majority of non-rigid airships were built at naval air stations such as Kingsnorth and Wormwood Scrubs with crews often standing by during construction before they accompanied the ship to its operational station. When problems arose, for example with the first batch of long-range ‘North Sea’ type airships, the decision was taken to resume production on an improved version of the Coastal class, the C Star to minimise delays.²⁰ The following table details the success of the airship programme:

Table 5. Airship production 1914-1918 ²¹

Type	Before Aug 1914	1914	1915	1916	1917	To 31 Oct 1918	Total
Various	6	1	1	-	-	-	8
Rigid	1	-	-	-	4	3	8
Parseval	1	-	1	-	2	-	4
S.S.	-	-	29	22	6	3	60
S.S.Z.	-	-	-	1	24	46	71
S.S.P.	-	-	-	-	6	-	6
S.S.T.	-	-	-	-	-	13	13
North Sea	-	-	-	-	5	7	12
Coastal	-	-	-	35	-	--	35
C. Star	-	-	-	-	-	10	10
Total	8	1	31	58	47	82	227

The production of a large number of non-rigid airships was one of the great success stories of naval aviation. Following the identification for a Submarine Scout (SS) type in early 1915 design was undertaken by a naval team led by Commander Cave-Brown-Cave.²² Production proceeded rapidly and by mid-June, twenty-four chassis had been completed, but problems were encountered with the quality of the fabric for the envelopes. Nevertheless, twenty SS ships were due for completion by the end of July and another

²⁰ Development of Airship Service 1914-1918, AIR 1/726/122/3.

²¹ Ibid.

²² J.S. Middleton, IWM/SA 38, Reel 3.

seven by mid-August.²³ At the same time thirty Coastal non-rigids were ordered all of which were delivered by the end of 1916 plus four for Russia and one for France.²⁴

From December 1915 the Superintendent of Aircraft Construction was responsible for a rigid airship's aeronautical excellence, especially fighting and scouting, and was consulted by Director of Naval Construction and Engineer-in-Chief. The Director of Air Services was to choose the most experienced officers and men from non-rigid airships to man them. The Superintendent of Aircraft Construction, Director of Naval Construction and Engineer-in-Chief were jointly responsible for ensuring that contractors were supplied with information for construction and handling arrangements for the ship on trials.²⁵

Approval for six S.S.P. (Pusher) airships was given in January 1916, but this type was quickly superseded by the S.S. Zero, seventy-one of which were eventually built plus two each for France and the USA. A twin-engined S.S. airship, known as the Mullion Twin, on account of the air station where it was designed entered service in 1918.

For longer range patrols in lieu of delayed rigid airships the North Sea type was approved in early 1916, although the first was not completed at Kingsnorth until January 1917 and entered service at Pulham in April and a dozen were built. In view of the delays to the North Sea airships, an improved version of the Coastal, the C. Star was ordered in late 1917 and ten were built before construction was terminated in favour of the Mullion Twins.²⁶ It was estimated that in production terms a C. Star airship was the equivalent of three S.S. Zeros and a North Sea type equalled five Zeros.²⁷

In August 1917 the Admiralty had a fleet of seventy non-rigids.²⁸ The final order of the war was for 103 S.S. Twins in July 1918 costing £772,500 with spares on the basis of 100% spare envelopes, 50% spare engines and 30% other parts costing £355,350.²⁹ In January 1918 it was agreed that the responsibility for the construction of airships and their sheds should be retained by the Admiralty even when the RAF was formed.³⁰

Procurement by the RNAS and the RFC

The success of naval aviation in co-operating with manufacturers on a wide range of types was not entirely favourable in the long term since it was not coordinated with the RFC and the latter complained that the navy was monopolising resources. In February 1916

²³ Minute from DAD to First Sea Lord, 9 Jun 1915, AIR 1/148/15/80.

²⁴ Decisions of airship conference, 19 Jun 1915, AIR 1/2553.

²⁵ Letter from Secretary of Admiralty to DAS, 28/12/1915, AIR 2/127.

²⁶ Report on SS, North Sea, Coastal and C Star airships, 1915-1918, AIR 1/727/152/5.

²⁷ Minutes of second Airship Progress Meeting, 4 Mar 1918, AIR 1/306/15/226/168.

²⁸ Admiralty Appreciation for War Cabinet, 30 Aug 1917, in Doc.185, Roskill, *Documents Relating*, 530-531.

²⁹ Minute by Vincent L. Raven, DCAP, 13 Jul 1918, AIR 2/163.

General Henderson, GOC, RFC accused the Navy of monopolising engine production³¹ with the result that the following month the RFC was seven squadrons and 275 aircraft below its approved establishment on the Western Front.³² Around the same time the War Office accused the Admiralty of monopolising French production: 'While the Army looked to the French supply as supplementary and as a reserve... the Navy have apparently considered the French market as the main source from which to provide their land aeroplanes for war purposes...'³³ In fact this is extremely complimentary about naval aircraft procurement since it was the RNAS and not the RFC which fully appreciated the quality of the French machines, which until 1916 were largely superior to their British counterparts.

The War Cabinet established an Air Board under Lord Curzon in May 1916 to co-ordinate the supply of resources between the two air departments. Curzon suggested that the Board should have 'general responsibility' for financial proposals with organisations were required to submit quarterly statements for the formation of new units and alteration of establishments, proposed orders for new aircraft and works costing over £2000. He met steadfast opposition from Arthur Balfour, the First Lord: '...the Navy cannot consent to regard itself as subject to any other Department in respect either of the organization of its Air Service, the designs of its air machines, or the use to which they are to be put.'³⁴ In August 1916 the Admiralty ignored the Air Board's proposals by ordering 2¾ million pounds of aircraft and engines without consulting it. The Secretary of the Admiralty justified this decision on the grounds that no inter-service competition was involved: '...no materiel was ordered from Contractors who habitually supply the Army; and that the Navy will do their best to supplement the resources of the Army should the need for this arise.'³⁵ The incident demonstrated the Admiralty's independence in aircraft procurement through its large range of contacts and extensive purchasing power, but in the long term could only weaken its position as the government wished to streamline production. Vaughan-Lee, Director of Air Services, fully supported the continuation of Admiralty control on the basis of that the RFC had lagged behind the navy:

³⁰ Operations Committee Minute No.29, 2 Jan 1918, in Doc.211, Roskill, *Documents Relating*, 595.

³¹ Note from GOC, RFC to War Committee, 28 Feb 1916, in Doc.99, Roskill, *Documents Relating*, 285.

³² Note from Imperial General Staff to Joint War Air Committee, 13 Mar 1916, in Doc.109, Roskill, *Documents Relating*, 319.

³³ Memorandum 'Remarks by Major-General Sir David Henderson on the Note by the Naval Representatives on the Joint War Air Committee', 31 Mar 1916, in Doc.111, Roskill, *Documents Relating*, 324.

³⁴ Minute from First Lord, 25 Jul 1916. ADM 1/8464/187.

³⁵ Letter from Secretary of Admiralty to Secretary of Air Board, 18 Sep 1916, ADM 1/8464/187.

‘... the Royal Flying Corps has always been about four or five months behind the Royal Naval Air Service in adopting new types. Especially is this the case in regard to engines – e.g. the orders under discussion, amounting to from 6,000 to 8,000 Hispano Suiza 200hp engines, were entirely initiated, and are being carried through, by our officers.’³⁶

In 1917 the design and supply of naval aircraft was transferred to the Air Board and the Ministry of Munitions, through the Department of Aeronautical Supplies which absorbed the design departments of the Admiralty and Air Ministry; one of this department’s primary task was to standardise production – there were 100 different types of aeroplanes and seaplanes being produced for the RFC and RNAS in 1917. The Air Board was responsible for the quantity and designs of aircraft ordered whilst the Ministry of Munitions would oversee production.³⁷ The Controller of Aeronautical Supplies adopted the RFC method of aircraft inspection to develop manufacturing capacity and the Admiralty policy of aircraft design, which placed responsibility on the staff of the aircraft companies.³⁸ This began a process, which was to result in the formation of the Air Ministry which controlled aircraft production of the inter-war years and then the Ministry of Aircraft Production during the Second World War.

The RNAS was also a supplier of aircraft and equipment to the RFC in a role reversal of the situation between 1939-1945 when the FAA was dependent on the RAF. As early as mid-December 1914, twelve Vickers and six Maurice Farman aeroplanes were supplied to the RFC.³⁹ By June 1915, sixty-five aircraft had been supplied and agreement reached for the transfer of another 100. When the RFC was faced with a reduction in strength of three squadrons in June 1916 due to a failure of supply of French Clerget engines the Admiralty approved the transfer of twenty Sopwith Type 9400 aircraft, twenty Nieuport two-seater machines, plus 20 Bristol Scouts.⁴⁰

Foreign production

Nor did the RNAS restrict itself to firms in Britain using the American Curtiss Company which pioneered the use of flying boats, the first of the H4 Small America type entered service in 1914, and H12 Large America in April 1917. As previously mentioned Curtiss also supplied a large number of training aircraft. Other important foreign aircraft

³⁶ Minute by DAS, 13 Nov 1916, in Doc.141, Roskill, *Documents Relating*, 410.

³⁷ Memorandum of functions of Air Board, 19 Jan 1917, ADM 1/8478/6.

³⁸ Report ‘Aircraft Design and Production, 1914-1918’ by J.C. Nerney, 12, Air 1/678/21/13/2186.

³⁹ Minute by DAD, 11 Dec 1914, ADM 1/8405/61.

included Nieuport Scouts, which equipped eight naval squadrons on Western Front in 1916-1917, and Caudron G4 twin-engined bombers, a forerunner of the Handley Page 0/100.

Pre-war French manufacturers led aircraft and engine design.⁴¹ In *The First Air War, 1914-1918*, Lee Kennett describes the development of aero-engine technology from the Gnome to the Hispano Suiza.⁴² For the early period of the war, French production was crucial to overall procurement; for example in January 1915 the prospect of meeting production targets in the next three months were entirely dependent on the large number of Renault and Canton-Unne engines which had been ordered.⁴³ Sueter also noted the restrictions on French orders at a conference in April 1915: ‘...there were great difficulties in obtaining deliveries because the French Government only allowed [the] War Office and Admiralty 15% of their output. This cut the number of French machines available to a very low figure.’⁴⁴ Overall the French contribution up to 27 February 1918 was 836 aeroplanes and eighty seaplanes and flying boats.⁴⁵ French engine production was especially important as the following table shows:

Table 6. Production of aircraft and engines, 1916 – 1917 ⁴⁶

	1916	1917
Aircraft (UK)	5,716	13,766
Aircraft (Imported)	917 (659 France)	1,016
Engines (UK)	5,363	11,763
Engines (Imported)	1,864 (France)	4,902

The great dependence on French production in the early years of the war was revealed when the British Ambassador in Paris informed the Foreign Office on 9 June 1915 that General Joffre would cut off aeronautic production unless a previous agreement to supply fifteen per cent of Lewis guns to the French was maintained.⁴⁷ The Director of the Air Department replied that Joffre’s requests must be met: ‘All the Naval aeroplanes which are

⁴⁰ Letter from DAS to Director General of Military Aeronautics, 28 Jun 1916, AIR 1/659/17/122/619.
⁴¹ ‘Aircraft Design and Production, 1914-1918’ by J.C. Nerney, 2, AIR 1/678/21/13/2186.
⁴² L. Kennett, *The First Air War, 1914-1918* (New York: Simon & Schuster, 1999), 102-106.
⁴³ Minute by DAD, 5 Jan 1915, ADM 1/656/17/122/557.
⁴⁴ Report of conference held by First Lord, 3 Apr 1915, ADM 1/8433/270B.
⁴⁵ French aircraft received by RNAS up to 27 Feb 1918, AIR 1/676/21/6/1820.
⁴⁶ J.H. Morrow Jnr, *The Great War in the Air: Military Aviation from 1909 to 1921* (Washington: Smithsonian Institution Press, 1993), 185 and 251; S.W. Raleigh and H.A. Jones, *The War in the Air: Being The Story Of The Part Played In The Great War By The Royal Air Force, Vol III* (Oxford: Clarendon, 1931), App VII.
⁴⁷ Telegram from British Ambassador, Paris to Foreign Office, 9 Jun 1915, AIR 1/668/17/122/776.

operating in the Dardanelles on purely military work are French machines, as also were the machines which successfully attacked Zeppelins and Zeppelin sheds on the Belgian coast...'⁴⁸ Nevertheless at the beginning of 1916 relations between the Admiralty and French manufacturers presented an unprecedented opportunity:

'...it is highly improbable that the R.N.A.S. will ever find themselves in a more advantageous position to place order than at the present time. It is obvious to those who have followed the results of production in both countries that (a) the type of war machine and of engines being produced in France is far superior to those of England, and (b) the production of France is incomparably superior...the only comparable machine to any in France is the 1½ Stutter Sopwith...'⁴⁹

In the case of Messrs Nieuport they not only gave the RNAS preference on production over all other Allies, but also on occasion over the French Government. In March 1916 the RNAS and RFC formed a Joint Army and Navy Purchasing Commission in Paris and met weekly to report on orders and deliveries.⁵⁰

In July 1916 it was also proposed to purchase 400, 200hp engines from the Hispano Suiza Company for the RNAS in tandem with the War Office, French and the Russians who wished to purchase 100 each. The raw materials would be sent out from Britain, except the aluminium supplied by the French Government.⁵¹ Squadron Commander Briggs went to Spain to approve the order, but in the aftermath of his experience before the Finance Committee in 1915 Sueter, SAC, refused to allow this as it had not been given financial approval and Squadron Commander Briggs was summoned to explain his 'short circuiting' of official procedures.⁵²

Engine production

Aircraft engines were the most complex components and the number of engines was the limiting factor on production. An agreement with the RFC at the beginning of the war saw the navy monopolize high-powered engines, initially for use in seaplanes. One of its navy's best decisions was to ask Rolls Royce to develop a 250hp engine, later the Eagle, the first of an extremely successful range of Rolls Royce power plants. The Eagle was difficult to mass-produce due to its complexity. Output was only 875 in 1917 and

⁴⁸ Minute by DAD, 15 Jun 1915, AIR 1/665/17/122/715.

⁴⁹ Statement of RNAS relations with Aeroplane Constructors and Firms in Paris, Jan 1916, AIR 1/148/15/78.

⁵⁰ Minutes of conference held in Paris, 8 Apr 1916, AIR 1/630/17/122/23.

⁵¹ Minute by DAS, 7 Jul 1916, ADM 1/2644.

production of the Eagle attained a peak of only thirty-eight units per week.⁵³ The following table shows production of various Rolls Royce engines:

Table 7. Production of Rolls Royce engines, 1915-1917 ⁵⁴

Type	1915	1916	1917	1918
Eagles	25	485	875	2695
Falcons	-	62	625	
Hawks	-	85	115	
Total	25	632	1615	
Repairs	-	12	327	

However Rolls Royce engines had an unparalleled reputation and Pilot Thomas Williams praised the 80hp Hawk engine in his SS Zero airship: ‘...in June of 1918 – one of my last flights at Anglesey – I did one flight of over twenty six hours with a Rolls Royce engine. I never hesitated, if necessary, to switch my engine off in the air knowing that I could re-start it again.’⁵⁵ In 1916 the RFC had invited Napier and Rolls Royce to design a 200hp engine, but Rolls Royce withdrew from the competition due to interference from the Royal Aircraft Factory. Napier proceeded with a Royal Aircraft Factory design for a 200hp engine, but large quantities were ordered before engine was unsuccessful resulting in considerable waste of time and effort. The effect of this decision was still being felt at the end of the war:

‘...this failure to develop the Rolls-Royce engine to the full at this period had a most profound and disastrous influence on aircraft production... this influence was felt most keenly in 1918 when the shortage of high-power engines precluded the full expansion of the strategic bombing offensive against Germany... The effect of this happening might have been even more serious had not the Admiralty... given considerable orders to Messrs Rolls-Royce and extended their works.’⁵⁶

⁵² Minute by SAC, 8 Jul 1916, AIR 1/2644.
⁵³ ‘Development of Aircraft Production, 1917-1918’ by J.C. Nerney, 162-163, AIR 1/678/21/13/2138.
⁵⁴ Engine power is 250hp Eagle, 190hp Falcon and 75hp Hawk; ‘Development of Aircraft Production, 1917-1918’ by J.C. Nerney, 162, AIR 1/678/21/13/2138.
⁵⁵ T.B. Williams, IWM/SA 313, Reel 6.
⁵⁶ Report ‘Aircraft Design and Production, 1914-1918’ by J.C. Nerney, 6, Air 1/678/21/13/2186.

In July 1917 the Air Board planned a programme of 4,000 engines a month by the autumn of 1918, the equivalent of 7,000 because a further seventy-five per cent were required in the form of spares. Henceforth a priority would be given to materials, labour and machine tools for the aircraft programme.⁵⁷ Aeronautics was the last large area to place a serious claim on industry during the First World War and so operated at a disadvantage. In addition the expanding RFC and RNAS were also in the market for mechanics to maintain their machines. In the autumn of 1917 it was estimated that forty-seven men were needed to maintain one aircraft in service at the front and 120 men were needed to produce one aircraft a month, so the production effort absorbed seventy-five per cent of the labour.⁵⁸ However, the difficulties of such a large expansion in engine production were highlighted by the problems with the series of new engines introduced in 1917, whose production statistics are highlighted below:

Table 8. Estimated engine production and deliveries, September 1917 – June 1918⁵⁹

Types	Estimated total	Estimated surplus	Actual deliveries	Actual deficit
B.H.P. and Fiat	4,115	1,183	2,374	558
Hispano-Suiza/ Sunbeam Arab	7,219	1,055	3,711	2,453
Clerget and B.R.1	4,580	1,064	2,486	1,030

The supply of Sopwith Cuckoo torpedo bombers was one an example of a serious delay due to these difficulties. The 200hp Hispano Suiza engine was selected before its development was completed and serious defects were experienced, causing its replacement by the new Sunbeam Arab. Unfortunately the Arab was still undergoing trials and not immediately available.⁶⁰ Pilot Phillip Bristow commented on production standards in 1918: ‘Engines too were manufactured by any firm with the right machine tools, and not unnaturally, quality varied accordingly. Thousands were produced in this way, but against this, losses were enormous, more perhaps by accident or poor workmanship than by enemy action.’⁶¹ In *The Birth of Independent Air Power* Malcolm Cooper relates the failure of the air expansion programmes planned by the Ministry of Munitions in 1917 to the wholly inadequate

⁵⁷ Report ‘Development of Aircraft Production, 1917-1918’ by J.C. Nerney, 43-44, AIR 1/678/21/13/2138.
⁵⁸ Ibid 3, AIR 1/678/21/13/2138.
⁵⁹ H.A. Jones, *War in the Air: Being the Story of the part played in the Great War by the Royal Air Force, Vol VI* (Oxford, Clarendon, 1937), 42.
⁶⁰ Letter from Secretary of Air Ministry to Secretary of Admiralty, 16 Sep 1918, AIR 1/643/17/122 257.
⁶¹ C.P. Bristow, ‘C.P. Bristow’s Memoirs – Part 2’, *Jabberwock* 48, Autumn 2002, 13.

airframe and engine production capabilities.⁶² Lord Cowdray, President of the Second Air Board, reported in October 1917 the problems coordinating aircraft and engine orders: 'Owing to the much longer period required for the production of engines than of aeroplanes, orders for the former must be placed for relatively long periods ahead, before it is known what types of aeroplanes will be required when the engines become available.'⁶³ On average it took thirty-four weeks to get an aircraft from design to production, but sixty-four weeks for engines.⁶⁴ Aircraft could be produced far more quickly than engines and in the summer of 1918 40% of aircraft produced for the RAF came without engines.⁶⁵

Inter-War Years

Administration of FAA procurement

At a first glance it is easy to lay blame at the Air Ministry's door for the unsatisfactory state of the quantity and quality of naval aircraft in 1939. After all it had ultimate control over aircraft design and procurement since 1918. However, there is little evidence of a deliberate policy towards the FAA as Andrew Gordon explained in his study of inter-war procurement: 'Judging from some of the types with which the RAF sought to stem the blitzkrieg in 1940, it cannot really be asserted that the Air Ministry singled-out the Fleet Air Arm for particular contempt.'⁶⁶ In her excellent account of Coastal Command's anti-shipping operations, Christina Goulter recalled the similar experience which that service had endured:

'Not all sections of the Royal Air Force benefited from the injection of defence funding after 1933, and just as maritime aviation was to suffer proportionately greater cuts in relation to other branches of the air force in the period of disarmament after the First World War, the maritime aspect grew most slowly when expansion of the air force occurred.'⁶⁷

When examining the size of the FAA it is important to note that as it was purely ship-based and the government refused to sanction the construction of aircraft without a carrier to go

⁶² Malcolm Cooper, *The Birth of Independent Air Power: British Air Policy in the First World War* (London: Allen & Unwin, 1986), 84-96

⁶³ Report from President of the Second Air Board to the War Cabinet, 12 Oct 1917, in Doc.199, Roskill, *Documents Relating*, 567.

⁶⁴ Report 'Development of Aircraft Production, 1917-1918' by J.C. Nerney, 5, AIR 1/678/21/13/2138.

⁶⁵ Abbateillo, 'British Naval Aviation and the Anti-Submarine Campaign.', 86.

⁶⁶ Gordon, *British Seapower and Procurement Between The Wars*, 227.

⁶⁷ Christina J.M. Goulter, *A Forgotten Offensive: Royal Air Force Coastal Command's Anti-Shipping Campaign, 1940-1945* (London: Frank Cass, 1995), 72.

with them. Nor did the Admiralty appear particularly enthusiastic about producing the number of aircraft it was allowed; in 1925 the Admiralty Board approved total of 334 aircraft by 1938, but this was reduced to 289 in 1927 and 251 in 1928 on the basis that carriers would not be provided with their full aircraft complement.⁶⁸ As a result was reduced to a trickle ‘...from the beginning of 1929 until 1932 the funds provided by the Admiralty were so small that only eighteen aircraft were added to the Fleet Air Arm.’⁶⁹ Small aircraft complements also encouraged the use multi-role aircraft to maximise the carrier’s capabilities.

As Hone, Friedman and Mandeles have suggested in their excellent account of inter-war air power development, the effect of dual-control was rather subtler than purely Air Ministry bias and more the process the Admiralty used for deciding what aircraft it wanted:

‘That the Fleet Air Arm did not do as well technically as its competitor in the USN can be laid largely to the absence of interacting organizations that would have allowed the proper level of assessment of professional technical advice within the Royal Navy. The absence of such organizational arrangements permitted a chain of unfortunate technological errors to remain uncorrected until World War II.’⁷⁰

The impact of the Admiralty drawing up specifications and using the aircraft while the Air Ministry designed and built them was encapsulated by Admiral Caspar John, who went on to serve in the Ministry of Aircraft Production during the Second World War: ‘The Admiralty was not competent to say what it wanted and the Air Ministry was not competent to advise.’⁷¹ While all observers and seventy per cent of pilots were naval officers, all the senior administrative personnel were from the RAF. Thus all the leading lights of the naval air service in the First World War were removed from the navy’s orbit and the possibility of attaining senior naval positions in later years. This reduced the ‘air-mindedness’ of the navy and meant the Admiralty was entirely dependent on the Air Ministry’s advice as the official history of British Naval Aviation made clear:

‘...all the higher technical and administrative responsibility was held by Air Force officers; thus, tactical progress and administrative development as well as

⁶⁸ Till, *Air Power And The Royal Navy*, 89.

⁶⁹ S.W. Roskill, *The War at Sea 1939-1935: Volume I, The Defensive* (London: HMSO, 1934), 31.

⁷⁰ Thomas C. Hone, Norman Friedman and Mark D. Mandeles, *American & British Carrier Development 1919-1941* (Annapolis: Naval Institute Press, 1999), 132.

⁷¹ Till, *Air Power And The Royal Navy*, 102.

the majority of air training problems were controlled from outside the Navy. Herein lies the principal explanation of British backwardness in naval aviation as compared with that in the United States and Japan.’⁷²

It left a far more complicated organisation than was really necessary for the successful development of naval aviation and compared poorly to the close co-operation between the United States Navy and their Bureau of Aeronautics:

‘...the naval commands attempting to develop the tactics of naval aviation; the naval constructors, designing the aircraft carrying ships; the R.A.F. personnel acquiring practical experience in handling of the aircraft operated from ships; and the Air Ministry staff and design departments upon whom the Navy depended for progress in aircraft design, air tactics and air equipment.’⁷³

One major criticism of FAA aircraft in this period is their reliance upon RAF types. Since all the armed services were short of finance it made sense for much of the inter-war era to use adapted RAF machines as the performance of carrier-borne and shore-based aircraft were largely similar. Some of the specialist naval aircraft, the Short seaplane, Supermarine Seagull and Fairey IIID seaplane were not particularly successful anyway. But this reliance also put the FAA at the mercy of Air Ministry designers who looked to build the best aircraft without taking into account naval considerations and probably not knowing the reasoning behind some of the Admiralty’s specifications, such as the need for two-seater aircraft for navigational purposes. The comparison with the system in the United States could not have been more striking where naval officers were involved in every stage of the process:

‘...it was thought possible to adapt a Royal Air Force type of aircraft to work from carriers or to suit naval tactical requirements, it was customary to view those [naval] requirements as a detraction and hindrance to the normal aircraft development. The opposite view, held by the American system, where the development was stimulated and directed by naval officers, was to look upon an aircraft as being deficient if it did not meet the requirements.’⁷⁴

⁷² Naval Staff History, *The Development of British Naval Aviation 1919-1945: Volume 1* (London: HMSO, 1950), 10, ADM 234/383.

⁷³ Ibid, 17.

⁷⁴ Naval Staff History, *The Development of British Naval Aviation 1919-1945: Volume 1*, 35, ADM 234 383.

The navy was also unfortunate that aircraft capabilities were transformed by the change over from biplanes to monoplanes which occurred in the mid-1930s with the development of high-powered engines:

‘...beginning of the steep improvement in aircraft engines that produced high-performance aircraft. At just this time, finances contracted, denying the Royal Navy the chance to increase the rated capacities of its carriers... Then rearmament, oriented mainly against Germany, presented the RAF with ample reason to constrict purchases of naval aircraft.’⁷⁵

Even if the navy had been granted more finance for production it is by no means clear it would have been able to take advantage of it. It needed its own research and design budget and technical advisers to discover the actual possibilities of the aircraft performance rather than assuming their limitations. For example the consequences of multi-role specifications were serious: ‘...The sixty-knot [catapult launch speed] and weight limits began to make it impossible for the Fleet Air Arm to take advantage of the improvements in aircraft technology.’⁷⁶ The Admiralty specified that aircraft should operate from carriers and ships’ catapults. By contrast the United States Navy operated specialist aircraft from catapults permitting the design of high-performance carrier-borne machines. This comes to the crux of Hone, Friedman and Mandeles’ argument:

‘The Admiralty’s carrier aircraft did meet its requirements, but unfortunately those requirements were not generated by organizations interacting in an experimental setting... In particular, the Royal Navy assumed that, to operate from a carrier, an airplane had to suffer limited performance. The assumption had a dramatic – and deadening – effect on the Royal Navy’s estimates of requirements.’⁷⁷

The ultimate example of this can be seen in the specifications what became the Blackburn Firebrand, the great white hope for the navy’s fighter units during the war. The major problem was that while it was touted as a single-seater in all other respects it had the characteristics of a two-seater:

⁷⁵ Hone, Friedman and Mandeles, *American & British Carrier Development 1919-1941*, 129.

⁷⁶ *Ibid*, 115.

⁷⁷ *Ibid*, 109-110.

‘In 1939 Director, Naval Air Division... [Captain Larcom] stung by complaints [from the Air Ministry] that the Admiralty’s demands for two-seaters were ruining performance, released a specification for a single-seater that would still meet standard requirements for range and take-off speed. He suggested that it would differ very little from the unsatisfactory two-seaters. The Blackburn Firebrand, which met the specification, proved his point. It ended up as a torpedo bomber.’⁷⁸

It was very much a vicious circle with the Admiralty demanding specifications than imposed serious restrictions on performance, but the Air Ministry not understanding the former’s reasoning and either unwilling or unable to suggest improvements: ‘...neither the administrative arrangements under which they [the aircraft] were supplied, nor the personal experience of those chiefly responsible for their design, appear to have been of the kind best calculated to produce the right types of carrier aircraft.’⁷⁹

Due to financial stringency in the 1920s when a number of firms went bankrupt the Admiralty was forced to deal with a relatively small number of companies who faced little competition in their area of specialisation. The procurement bottlenecks which affected the navy more widely were replicated in the field of naval aviation. Sopwith, perhaps the most famous manufacturer of naval aircraft in the First World War, went bankrupt in the 1920s and by the mid-1930s the Admiralty was largely dependent on only two manufacturers, Fairey and Blackburn. The substantial criticism, which was directed at these firms by the Admiralty during the Second World War, should be tempered with the recognition at the lack of orders they had received for many years and the sudden requirement for mass production of naval aircraft.

British production

The difficulties of a small industrial base and a disjointed procurement process can be illustrated by development of strike and fighter aircraft respectively. The famous Fairey Swordfish, the most important strike aircraft in the early war years, was the result of consultation in the early 1930s between Fairey’s and Captain H.C. Rawlings of HMS *Devonshire*, a future Director of the Naval Air Division. The prototype flew in 1934 and the aircraft entered service in 1936.⁸⁰ The requirements for the Swordfish’s replacement, the Albacore, were issued in June 1936. While Fairey’s submitted monoplane and biplane

⁷⁸ Ibid, 119.

⁷⁹ Naval Staff History, *The Development of British Naval Aviation 1919-1945: Volume 1*, 29, ADM 234/383.

⁸⁰ Ibid, 68.

designs, it was decided that it was too risky to order a monoplane because of the long time it would take to develop and complete trials. Initial orders for 100 Albacores were placed in 1937, increased to 400 in October 1938 but there were delays due to problems with its Taurus engine.⁸¹

Subsequent discussions regarding the priority between the Swordfish and Albacore highlighted two major problems of the procurement process. Firstly, the small orders hardly encouraged the manufacturers to invest in mass production techniques. Secondly, in the late 1930s the Admiralty was entirely dependent upon just one factory, Fairey's at Hayes, for the production of its strike aircraft. Therefore there would a gap between production of one type being completed and the next type getting under way while the factory was re-tooling. Delays in production of the Albacore brought these problems to a head in the autumn of 1938 as Captain Boucher, Director of Air Material, explained:

‘...the Admiralty is in the position of having consecutive types of this class of aircraft emanating from the same factory. This means it is impossible to have production of the two types simultaneously. The factory organisation allowed for the existing Swordfish production to overlap the initial trials of its replacement (the Albacore) but now delays in production of the latter have brought us to the position where Swordfish production has practically come to an end... at best, if the Albacore is a success and free from all except normal “teething” troubles there will a gap of a month or two in production...’⁸²

Boucher foresaw an even greater problem if the Albacore was a failure when the factory might take up to four months to re-organise. Given the production problems with the Albacore and the need for the maximum number of strike aircraft in the short term with the unstable international situation it was only matter of time before it was decided to reinstate Swordfish production. The Fifth Sea Lord and representatives of the Air Ministry meeting on 27 September concluded that the Hayes factory should re-tool to produce 200 Swordfish starting in February 1939.⁸³ In the light of the Swordfish's subsequent unparalleled war record it is worthy of note that it would have gone out of production in October 1938, but for the paucity of aircraft production facilities.

⁸¹ M.M. Postam, D. Hall and J.D. Scott, *Design and Development of Weapons: Studies in Government and Industrial Organisation* (London: HMSO and Longmans, Green & Co, 1964), 134 & 146.

⁸² Minute by DAM, 22 Sep 1938, ADM 1/10114.

⁸³ Minute by DAM, 27 Sep 1938, ADM 1/10114.

Unfortunately for the FAA the position regarding strike aircraft was positively healthy when a comparison is drawn with the production of fighters. It is in this sphere that the total incompatibility of dual control with procurement was revealed. The Air Ministry's inability to deliver was apparent to the Head of Air Branch as far back as 1933 during discussions on the future Blackburn Skua:

'...we do not yet know whether the Air Ministry will be able to pronounce that the aircraft *when produced* [author's italics] will be a capable fighter... In any case at least four years will elapse before it is in production and the Commander-in-Chief is asking for fighters now.'⁸⁴

If the Air Ministry, the FAA's technical advisor, was unable to state what would or would not be a capable fighter it placed the Admiralty in a difficult position at this early stage. Rear Admiral C.E. Kennedy-Purvis, Assistant Chief of the Naval Staff in 1936, sheds very interesting light on the procedure or lack of one which was adopted by the Admiralty in the design process:

'It is perhaps unfortunate that this aircraft [Skua] will be in production before the D.B.R. [Barracuda], but this is because it was not developed to Staff requirement in accordance with a settled policy: it merely grew out of the idea that a dive-bomber was required and could probably best be designed with a fighter type.'⁸⁵

In addition to the navy's uncertainty, the evidence appears to suggest that the Air Ministry, allegedly in charge of the design and development of aircraft, knew little better of how the aircraft might expected to perform:

'At present the Admiralty is being blown hither and thither. In the case of the Skua, for example, the Air Ministry have informed the Admiralty that this aircraft has grave defects as a dive bomber. This led to the Admiralty contemplating the abandonment of this function in the Skua, but the Air Ministry are now apparently pressing that the dive bombing function should be retained.'⁸⁶

⁸⁴ Minute by Head of Military Branch, 19 Dec 1933, ADM 1/9007.

⁸⁵ Naval Staff History, *The Development of British Naval Aviation, Volume 1*, 77, ADM 234 383.

⁸⁶ Minute by Head of Military Branch, 6 Oct 1938, ADM 1/10113.

Relations were similarly strained over the future of Blackburn Roc, a four-gun turret fighter, when the Air Ministry proposed in September 1938 that it should be cancelled, although according to the Admiralty no new evidence was produced. Captain C.M. Graham, DNAD, raised the fundamental issue, also highlighted by Geoffrey Till and Andrew Gordon that the Air Ministry was the judge and jury on naval air matters:

‘Constitutionally the Air Ministry are the Admiralty’s technical advisers. If we are confident of their efficiency there would be no question that the Roc would be rejected out of hand; our doubts in the matter are, however, justified by the fact that it has taken four years to come to an adverse decision. But since Admiralty has no technicians to advise in this matter we are not competent to insist pressing forward with the contract.’⁸⁷

In the event the Air Ministry decided to continue with production of the Roc, although it proved singularly unsuccessful in service. But the lack of technical competence within Admiralty was to remain a problem for much of the war.

Second World War

Administration of FAA procurement

The Ministry of Aircraft Production (MAP) was formed in 1940 under Lord Beaverbrook with responsibility for aircraft production for the RAF and the FAA. In one of its first acts on 17 May 1940 the Admiralty was informed that sub-contractors had been ordered to give first priority to five RAF types, the Hurricane, Spitfire, Blenheim, Whitley and Wellington; Captain Slattery, Director of Air Material, predicted serious consequences from this move: ‘...all the aircraft manufacturers engaged on Fleet Air Arm production will be seriously impeded by the non-arrival of component parts and raw material.’⁸⁸ Production of the Fulmar and Albacore were most seriously affected. While this instruction remained formally in place for only three months, Slattery believed that as a result of this decision the FAA was afforded secondary importance in the minds of many MAP staff for a considerable time. A scheme for a folding wing version of the Spitfire was abandoned in 1940 due to a lack of production capacity and there was a clash over the availability of Sabre engines for FAA Firebrands and RAF Typhoons in February 1941 when

⁸⁷ Minute by DNAD, 3 Oct 1938, ADM 1/10113.

⁸⁸ Paper from DAM to Fifth Sea Lord, 20 May 1940, ADM 116/5348.

Beaverbrook informed Alexander, the First Lord, that he could provide two Sabre engines for the Firebrand prototypes, which resulted in a scathing response from Alexander:

‘...I note with appreciation that you can let me have two engines for the prototypes, though actually I need three. The rest of your letter, to use an old saying, asks me to rely on the “sweet by and by”. The need for a fighter of this performance to protect the Fleet is already apparent, and cannot wait as long as that. The Navy has a just claim to its share of the best products of the British aircraft and aero-engine industry. The allocation for which I ask must be small in comparison with the production which will be provided for the R.A.F.’⁸⁹

The navy was also seen to be getting something of a raw deal when the facilities at Westlands and Boulton Paul were transferred for the production of the Barracuda. The previous products from both factories had been withdrawn from service, hence their availability. In January 1943 Admiral Dreyer, Chief of the Naval Air Service, blamed the production deficiencies on MAP’s failure to supply Barracudas, folded wings for Seafires and the long delays for the Firebrand and Firefly. He also pointed out because of the priority given to the bombing of Germany the FAA had a relatively small proportion of British aircraft production capacity, only eleven per cent compared with the twenty-two per cent which was allocated in America to the USN. Dreyer had especially strong views regarding the availability of aircraft for the Battle of the Atlantic: ‘We should not also bomb Germany with the Blood of the Merchant Navy.’⁹⁰

The following month Lord Chatfield, former First Sea Lord, put forward a motion in the House of Lords criticising the administrative chain for the supply of aircraft to the FAA and Coastal Command.⁹¹ Rear Admiral Portal, Assistant Chief of the Naval Staff (Air), did not believe this would be beneficial: ‘Public discussion of matters which are the subject of constant and delicate negotiations between the services, can do nothing but harm; it generally leads to other controversial issues being raised... and so retards the progress which we hope we are making towards the establishment and maintenance of good relations...’⁹² Boyd, the Fifth Sea Lord, agreed with this assessment: ‘I am quite sure that with the present contribution of the M.A.P. the administrative is satisfactory.’⁹³

⁸⁹ Letter from First Lord to Minister of Aircraft Production, 7 Feb 1941, ADM 1/13488.

⁹⁰ Report from CNAS to Admiralty, 13 Jan 1943, ADM 1/13484.

⁹¹ Minute by A. Clifton-Taylor, Cabinet Section, 15 Feb 1943, ADM 1/13963.

⁹² Minute by ACNS (A), 18 Feb 1943, ADM 1/13963.

⁹³ Minute by Fifth Sea Lord, 19 Feb 1943, ADM 1/13963.

However, as in the inter-war years when the Air Ministry came in for serious criticism from the navy, it should not be assumed that MAP was solely to blame for failures of aircraft procurement. There is also evidence that for some years the navy had not taken aircraft production seriously; for example no members of the FAA Advisory Committee, which advised on the transfer of the FAA between 1937-1939 had any technical expertise. It was not until March 1941 that a Chief Naval Representative (CNR) and a technical staff were appointed to MAP to represent the navy. By August 1943 there were forty-four naval officers and technical civilians on CNR's staff and the office handled 1400 Admiralty papers per month.⁹⁴ Churchill had criticised the Admiralty's procurement policy in mid-1942: 'In my opinion, the Admiralty themselves are very largely to blame for the present very satisfactory condition of the aircraft of the FAA... by not having a clear view of what was wanted [and] by repeated alterations [to designs]...' ⁹⁵ In his assessment of wartime procurement in June 1943, Commodore Slattery, CNR and former Director of Air Material at the Admiralty, placed considerable blame for the lack of proper direction of aircraft procurement in the latter part of 1941 and the summer of 1942 on the Admiralty rather than the MAP:

'The outlook of the Board of Admiralty to aircraft has been one of scepticism. They have never been convinced until six to nine months ago that they were really important. They realised it was a new factor but did not really understand the possibilities because they did not know anything about the technical side and were unable to state their case to the Cabinet or Chiefs of Staff meetings.'⁹⁶

The lack of adequate technical expertise within the Admiralty to advise on aircraft programmes, undoubtedly a hangover from the dual control arrangement until 1939, remained for a considerable period of the war. In a debate on Navy Estimates in March 1943, Mr Hopkinson MP, an engineer who had served in the Department of Aircraft Repair and Maintenance for eighteen months, criticised the Admiralty's aeronautical experience:

'It is a lack of a technical staff strong enough, and of great enough experience in aircraft design and construction to be able to criticise designs and to save the

⁹⁴ Extract from Aircraft Supply Council 14/43, 3 Aug 1943, AVIA 46/136.

⁹⁵ Minute by Prime Minister, 5 Aug 1942, PREM 3/171/9, taken from Till, *Air Power and the Royal Navy*, 106.

⁹⁶ Interview with Commodore Slattery, CNR, 25 Jun 1943, AVIA 46/136.

country from having to put up with inferior machines... there is no one at the Admiralty capable of saying what design should be.'⁹⁷

Admiral Boyd, the Fifth Sea Lord, commented: 'As usual the Admiralty is blamed for a national deficiency' and he blamed the lack of aeronautical engineers in the aircraft industry on a slump in engineering as a whole in the inter-war years.⁹⁸ In order to improve the Navy's assessment of new aircraft designs Alexander, the First Lord, suggested it should hire a suitably qualified Chief Designer. However, Boyd did not believe there were any suitable candidates:

'The difficulty lies in getting a big enough man. There are a lot of experts who are capable of limited criticism on one or other aspect, but I doubt if anybody in the M.A.P. is really confident to criticise design as a whole... All Chief Designers are working with firms, and, although it would be economical at £20,000 a year to attach one as our aircraft critic, I doubt whether anybody would allow one to leave his present work.'⁹⁹

The Fifth Sea Lord had had offers from engineers whom he regarded as second rate and therefore did not make an appointment fearing 'second rate criticism' and preferred to rely on: '...M.A.P. with all its limitations and its lack of first class men, is a better safeguard...'¹⁰⁰

Aircraft specifications

Before analysing the success of naval aircraft procurement in meeting production expectations it is useful to examine what types of aircraft the Admiralty wanted throughout the conflict. The autumn of 1940 saw the navy largely operating pre-war types; the Swordfish and the new Albacore in the strike role with the new Fairey Fulmar two-seater fighter operating from carriers in the Mediterranean. On the back of the experience with Fulmars, 181 Martlets single-seater fighters had been ordered from the USA¹⁰¹

In July 1941 problems were being experienced with the development of the Barracuda and it was acknowledged that British aircraft production was not capable of

⁹⁷ Extract from Navy Estimates Debate, House of Commons, 17 Mar 1943, ADM 1/14901.

⁹⁸ Minute by Fifth Sea Lord, 13 Apr 1943, ADM 1/14901.

⁹⁹ Ibid.

¹⁰⁰ Ibid.

¹⁰¹ Naval Aircraft, Periodical Summary No.1, Period ended 20th Sept 1940, 6, C.B.3053 (1), Admiralty Library, Portsmouth [Further references to Admiralty Library will be referred to as AL].

being expanded to meet the requirements of the new CVEs coming into service and two types of American strike aircraft, Chesapeake dive-bombers and Grumman torpedo bombers, later known as Avengers, were earmarked for this purpose. Fulmars and Martlets were the standard carrier fighters and in the latter the navy had a fighter with a performance capable of matching land-based types: 'Several opportunities have occurred during the past month of comparing the performance of the Martlet with Hurricanes flown by the Royal Air Force. Dog-fights have been arranged in which the Martlets have had not the slightest difficulty in shooting down the Hurricanes at heights up to 15,000 feet.'¹⁰²

By the end 1941, the Admiralty had approved staff requirements for three types of carrier-borne aircraft; the single-seater fighter, the two-seater strike escort and night fighter and the torpedo-bomber reconnaissance aircraft. The need for the single-seater fighter, not a requirement in the late 1930s, now drove the policy:

'...the main reason which led to the adoption of a three-type policy was the paramount necessity of providing a really high performance fighter for Fleet defence. The only way that this could be attained was to confine this type to the bare requirements of Fleet defence, which entailed abandonment of navigational facilities and *a considerable reduction in endurance*, these latter being previously required for a fighter which might be called upon for striking force escort duties.'¹⁰³

In the short term Martlets and Sea Hurricanes would have to fill the single-seater fighter role pending conversion of the Supermarine Spitfire V and trials of the new Blackburn Firebrand. In the middle of 1942 the experiences of the British in the Indian Ocean and Americans in the Pacific also changed the perception of the capabilities of strike aircraft:

'...even with the advent of the Barracuda, the T.B.R. type with its limited speed and performance and poor armament is no longer suitable for reconnaissance or attack in clear weather by day in face of fighter opposition unless escorted...'¹⁰⁴

The provision of long-range high-performance carrier-borne fighters for the FAA was not achieved until the introduction of American Grumman Hellcats and Chance Vought

¹⁰² Naval Aircraft Progress and Operations, Periodical Summary No.3, Period ended 13 Jul 1941, 6, C.B. 3053 (3), AL.

¹⁰³ Naval Aircraft Progress and Operations, Periodical Summary No.4, Period ended 25 Dec 1941, 8, C.B.3053 (4), AL.

¹⁰⁴ Naval Aircraft Progress and Operations, Periodical Summary No.5, Period ended 30 Jun 1942, 8, C.B.3053 (5), AL.

Corsairs in 1943. By the end of 1942 the imperative of getting the maximum number of aircraft into service as quickly as possible to feed the large expansion programme solved the navy's dilemma over variety of types for production: '...it has been decided to adopt the short term policy of developing the Seafire, Barracuda and Firefly to provide improved Fighter, Reconnaissance and Torpedo-Dive-Bomber aircraft.'¹⁰⁵ Three years into the war the debate on the design and suitability of fighter types was still continuing:

'...for the defence of the Fleet we require a single-seater day fighter of the highest possible performance. It is the policy that, if possible, its armament shall be four 20 mm guns. The problem of how to provide this aircraft with an endurance matching that of the striking forces had not yet been solved... It may yet be necessary to resort to distinct "short-range" and "long-range" types of day fighter.'¹⁰⁶

The answer, of course, was simply that no British designed aircraft could solve this conundrum. The Hellcat and Corsair easily filled the gap when they entered service in 1943, illustrating the stark contrast between the doctrines the two navies.

By mid 1943 the Admiralty had bowed to the inevitable also decided to accept a division in their reliance on British and American production: 'The present policy is to concentrate British designers on developing short-range high-performance interceptor aircraft, while we rely on the American long-range single-seater aircraft and our own Firefly for the escort rôle.'¹⁰⁷ This decision was approved in the first report of the Aircraft Design Sub-Committee of the Future Building Committee.¹⁰⁸ It was also confirmed that no further TBR designs would be considered after the Barracuda:

'...the Design Committee recognised the implications of departing from this "maid of all work" type which has proved so successful, but felt that with the increase in the number of carriers which will be available in future, an increase in the number of types, with the object of securing aircraft of generally better, performance, could now be more readily accepted than in the past.'¹⁰⁹

¹⁰⁵ Naval Aircraft Progress and Operations, Periodical Summary No.6, Period ended 31 Dec 1942, 9, C.B.3053 (6), AL.

¹⁰⁶ Ibid.

¹⁰⁷ Naval Aircraft Progress and Operations, Periodical Summary No.7, Period ended 30 Jun 1943, 13, C.B.3053 (7), AL.

¹⁰⁸ First report of Aircraft Design Sub-Committee of the Future Building Committee, 4 Jul 1943, ADM 1/15013.

¹⁰⁹ Paper 'Naval Aircraft – Progress with New Design, Mar-Jun 1943, by CNR, 15 Jun 1943, ADM 1/15013.

At the end of 1944 the appearance of the jet engine was recognised as revolutionising the potential of fighters, although in the short term the high fuel consumption was seen as limiting its application to short-range fighters. As a result of the successful performance of Corsair and Hellcat fighter-bombers, the Admiralty made finally acknowledged that single-seaters could perform the strike role: 'The successes of the Corsair, and similar shore-based aircraft, in the fighter bomber role, have made it appear that for many types of daylight operation, single-seater, high-performance aircraft are more suitable as a striking weapon, than the previous two-to-three seaters in use in the Navy.'¹¹⁰

By the end of the war there was a concentration upon single role aircraft and the pre-war assumption that carrier-based aircraft were by their very nature inferior to land-based counterparts had been long since abandoned: '...it being the policy that all roles... shall continually be met with the most efficient type of aircraft which can be operated from a carrier (and in some cases it is considered they may well be superior to their shore-based counterparts)...'¹¹¹ Reflecting the much closer relationship between the Admiralty and aircraft manufacturers forged during the war, the latter would not be rigidly bound by the official specifications:

'...for whatever role an aircraft design is required, it must be fundamentally a good aircraft of its type. The designers therefore are not tied down by crippling staff requirements. They are informed of the approximate weight, size, speed, endurance, weapon-carrying capacity, etc., as a guide to the main characteristics which it will be necessary for the aircraft to have to meet the requirements...'¹¹²

Despite the improved system of aircraft procurement, the complexity of modern aircraft meant there was still a considerable development period: '...it should always be remembered that from the time an aircraft is projected until the time it appears in service is on an average three years. In time of peace it may be expected to be more like 4½ years.'¹¹³

Aircraft orders and production

The failure to consider the development of a high-performance single-seater naval fighter in the inter-war period led to a total dependence on the RAF and American

¹¹⁰ Naval Aircraft Progress and Operations, Periodical Summary No.10, Period ended 31 December 1944, 12. C.B.3053 (10), AL.

¹¹¹ Naval Aircraft Progress and Operations, Periodical Summary No.11, Period ended 30 June 1945, 16, C.B.3053 (11), AL.

¹¹² Ibid, 15-16.

¹¹³ Ibid, 16.

production. In both cases the navy depended on the goodwill of these organisations for supply. Admiral Lyster, the Fifth Sea Lord, contacted Admiral Little, Head of the British Admiralty Delegation in Washington in September 1941 to emphasise the necessity for American fighters to meet expansion requirements. A complement of 120 aircraft for ten squadrons was required by the spring of 1942, but only half could come from RAF production. The only British single-seater, the Firebrand, was not due to commence production until the summer of 1942 and therefore five squadrons of Martlets were needed.¹¹⁴ The British Aircraft Commission in Washington informed MAP in January 1942 that a long-term target of 440 fighters was not possible through a reliance on the Martlet alone as only 300 of this type was available. Therefore efforts were to be made to obtain eighty of the new Corsairs.¹¹⁵ The early Hurricanes supplied to the navy were aircraft which had previously been in service with the RAF as the Vice Admiral, Naval Air Stations noted in September 1941: ‘One particular case may be quoted; N.2455 has since October 1939 been in two different Royal Air Force Squadrons, took part in the Battle of Britain, and was twice extensively damaged, once by forced landing and once by enemy action, before being converted to Sea Hurricane.’¹¹⁶ The primary concern was the effect on the morale of the aircrews: ‘Many of the Pilots joining will be young and enthusiastic officers, joining an Operational Squadron for the first time, and to be given an aircraft which can only be described as a “cast off from the Royal Air Force” causes a considerable damping of their ardour.’¹¹⁷ However, as Captain Huskisson, DAM, pointed out the Admiralty had no contracts for the production of Hurricanes at that time and therefore simply had to accept whatever aircraft were available.¹¹⁸

Alexander, the First Lord informed Churchill in October 1942 that to meet the expansion plans under Programme A, which envisaged 2689 first line aircraft in July 1946, there would be a deficiency of up to 1000 fighters and 1500 TBRs exist in mid-1943. To reduce the fighter deficit by 500, production at Supermarine would not be closed down in March 1943 and production was to be increased at Westlands as soon as possible. Peak capacity for Swordfish, Barracudas and Fireflies would be maintained from latter half of 1944 when current contracts were due to expire, to the end of 1946.¹¹⁹ Negotiations were also continuing for increased production from the USA. The following month Vice Admiral Power, Assistant Chief of Naval Staff (Home) and Rear Admiral Rawlings, Assistant Chief

¹¹⁴ Letter from Fifth Sea Lord to Head of BAD, Sep 1941, CAB 122/142.

¹¹⁵ Telegram from BAC to MAP, 6 Jan 1942, CAB 122/142.

¹¹⁶ Letter from VANAS to Secretary of the Admiralty, 21 Sep 1943, ADM 1/13522.

¹¹⁷ Letter from VANAS to Secretary of the Admiralty, 21 Sep 1943, ADM 1/13522.

¹¹⁸ Minute by DAM, 6 October 1941, ADM 1/13522.

of Naval Staff (Foreign), complained that there was a considerable disparity between the approval of naval air expansion programmes and aircraft production:

‘The lack of priorities for the Fleet Air Arm still exists, as shown by the fact that the Cabinet on the one hand have approved our carrier building programme and on the other hand have denied us the right to any additional aircraft productive capacity. The result has been that we have been forced to go to America for at least 40% of our immediate requirements. This source of supply is becoming increasingly uncertain and the future types are unsuitable.’¹²⁰

The following table shows the aircraft production totals for 1942:

Table 9. Aircraft production, 1942 ¹²¹

	Type	Quantity
British naval production	TBR's	536
	Single-seater fighters	0
	Two-seater amphibians	120
	Amphibians	208
	Non-operational	74
Total		<u>938</u>
American production	Torpedo bombers	6
	Single-seater fighters	279
	Two-seater fighters	0
	Light Reconnaissance	100
	Non-operational	38
Total		<u>423</u>
Releases from RAF	Spitfires	310
	Hurricanes	198
	Non-operational	117
Total		<u>625</u>
Grand Total		1986

While the British naval production dominated as far as strike aircraft were concerned, the largest contributor of fighters was the RAF with the Americans also making an important qualitative input in this field. The views of Power and Rawlings were reinforced at the

¹¹⁹ Minute from First Lord to Prime Minister, 25 Oct 1942, AVIA 9/42.
¹²⁰ Minute from ACNS (F) & ACNS (H) to VCNS on Question by Lord Cork, 23 Nov 1942, ADM 205/18.

beginning in January 1943 when MAP informed the Admiralty that no further British capacity could be allocated to production of naval aircraft so the FAA would be dependent on America for half of its production. It was hoped to increase British production in 1945, but this would not be possible in 1944 owing to a shortage of manpower.

Expansion Programme B which supplemented Programme A in January 1943 envisaged a reduction of first line strength on 1 January 1944 to only 1150 opposed to 1745.¹²² Even under these circumstances MAP forecast that the deficiency in TBR production would be equivalent to those required for eight CVEs at end of 1943 and as there would be serious shortage of single-seaters the Air Ministry was to be asked to convert 200 Spitfires to Seafires. The following month, Alexander, First Lord, informed Sinclair, the Secretary of State for Air, that on account of latest MAP plans and the comparative failure of Lyttleton Commission to the USA to obtain the additional fighters and TBRs:

‘It is clear that 1943 is going to be a bad year for us. It will be impracticable to form a single alternative armament squadron, and we estimate that even if all our existing shore-based squadrons are disbanded and reserves of all kind reduced to a minimum, there will still be shortages during the year of about 700 T.B.Rs and 200 single-seater fighters.’¹²³

The difficulties were borne out by the actual production for British types in 1943 as demonstrated by the following table:

Table 10. Forecast and actual British aircraft production, 1943 ¹²⁴

Type	MAP forecast in June 1942	Actual production in 1943	Deficit
TBR	2360	1201	-1159
Fighters	981	375	- 606
Total	3341	1576	- 1765

Admiralty delegations also visited Washington in November 1942 and June 1943 to agree future six monthly allocations. The agreement in June 1943 was to cover the first six

¹²¹ Paper ‘Fleet Air Arm – Facts and Figures’ by Air Branch, 16 Jan 1943, ADM 116/5348.

¹²² Memorandum from Air Branch to First Lord, 12 Jan 1943, ADM 1/14873.

¹²³ Letter from First Lord to Secretary of State for Air, 2 Feb 1943, ADM 1/14873.

¹²⁴ Minute from C.G.J. to Captain E.J.S. Clarke, 6 Apr 1944, ADM 1/17095.

months of 1944, but during the following mission of December 1943 the Americans greatly altered their offer:

Table 11. Monthly assignments of US aircraft for the first six months of 1944 ¹²⁵

Type	Assignments agreed in June 1943	Assignments scaled down for US production shortfalls	US offer In December 1943
Wildcat	60	50	20
Corsair	60	53	118
Hellcat	40	40	13
Avenger	45	43	23
Helldiver	30	21	1

This table graphically illustrates the problem of depending on the USN, for while the aircraft were generally excellent, the FAA was subject to changing USN requirements. The only action that could be taken regarding British production was a request for a quick turn-over of capacity after the defeat of Germany.

Britain’s overall manpower crisis also had an effect on aircraft production as detailed in the revised of aircraft programme of January 1944. At that time the naval production utilised six per cent, which was estimated to rise to nine per cent by 1945, although this had to take into account that MAP was required to reduce its overall manpower by 155,000.¹²⁶ The FAA could make some easy concessions since the Firebrand would not enter fighter production and Swordfish production would cease. It would also see a reduction in the number of Fireflies available:

Table 12. Effects of manpower reductions in naval aircraft production, 1944-1945 ¹²⁷

Aircraft	Factory	Reduction,1944	Reduction, first half 1945	Estimate of overall labour saving
Firefly	Fairey (Hayes), General Aircraft	80	75	5,000
Firebrand	Blackburn (Brough)	-	-	3,000
Swordfish	Blackburn (Sherburn)	405	325	8,000

¹²⁵ Minute from First Lord to Prime Minister, 22 Mar 1944, ADM 1/17095.
¹²⁶ Minute by DAE, 21 Jan 1944, ADM 1/16580.
¹²⁷ Note by Minister of Aircraft Production and First Lord, 20 Jan 1944, ADM 1/16580.

For 1943-1944 sufficient figures are available to make comparisons between the success of British and American procurement as is demonstrated in the following table:

Table 13. Forecast and actual aircraft production, April 1943 – March 1944 ¹²⁸

Type	Forecast	Actual	Deficit/surplus
<u>TBR</u>			
Barracuda	927	825	- 102
Swordfish	620	623	+ 3
Avenger	690	604	- 86
Helldiver	140	20	- 120
Total	2377	2072	- 305
<u>Fighters</u>			
Seafire	375	333	- 42
Hurricane IIC	24	24	-
Wildcat	509	359	- 150
Hellcat	298	229	- 69
Corsair	505	578	+ 73
Firefly	303	104	- 199
Total	2014	1627	- 387

The only British aircraft to meet production targets were the Hurricane, which was produced in small numbers and the Swordfish which had been built since the pre-war era. The most notable statistic was the success of Corsair procurement and this can primarily attested to the efforts of Lieutenant Commander Smeeton, the senior Admiralty representative with the British Aircraft Commission in Washington in 1941-1942. Initial orders of the Corsair were small compared with the Hellcat because there were concerns that the Corsair with wings folded would be too tall for the hangers of British Fleet Carriers. Smeeton informed the Admiralty it was likely that the Corsair could be modified and pressed for all American offers to be accepted as Captain Bridge, DNAD noted: ‘...[Smeeton] lays great stress on the fact that if aircraft are refused now the opportunity will not come again.’¹²⁹

When all the arguments had been made for the requirements for US aircraft, Admiral Lyster, the Fifth Sea Lord, acknowledged Smeeton’s crucial role in the acquisition process:

¹²⁸ Minute from C.G.J. to Captain E.J.S. Clarke, 6 Apr 1944, ADM 1/17095.

‘The ever changing situation of the war causes us to re-cast our ideas frequently... I am, however certain that we shall never have enough aircraft to meet our future commitments and I welcome the initiative shown by Lieutenant Commander Smeeton in earmarking this proportion of American aircraft for us and consider he should be fully supported.’¹³⁰

Lieutenant Commander Douglas Parker, CO of 1842 Squadron, flew Corsairs in the Pacific in 1945 and recalled his immense gratitude to Smeeton for originally taking a chance in obtaining the aircraft:

‘...we were very very lucky to get those aircraft, very lucky indeed. Thanks to a particular naval officer of the Fleet Air Arm, Dick Smeeton, who when Naval Air Attaché in Washington saw that these aircraft were proving a bit unpopular with the Americans who... were going largely for the Hellcat fighter. He opted to buy the Corsair on his own initiative without reference to their Lordships and the Treasury. In fact he ordered the first 200 of his own responsibility before getting it endorsed by their Lordships and the government of the day. A very bold decision and one that was of immense value to the British Navy.’¹³¹

The fortuitous nature of Smeeton’s intervention can be seen from the fact that almost one-third of the American aircraft delivered to the FAA were Corsairs; 314 in 1943, 1423 in 1944 and 230 in 1945.¹³² This was primarily due to the initial deck landing problems experienced by USN in operating the aircraft which resulted in the RN being the first navy to use it operationally from a carrier in April 1944. By the end of the war the Corsair was widely in widespread service with the USN and acknowledged as the best naval fighter of the war.

The British and American production totals for 1944 enable a comparison to be made between their relative contributions:

¹²⁹ Minute by D.N.A.D., 29 April 1942, ADM 1/11941.

¹³⁰ Minute by Fifth Sea Lord, 18 May 1942, ADM 1/11941.

¹³¹ D.G. Parker, IWM/SA 15533, Reel 3.

¹³² History of Naval Store Department in North America; Section 3, Appendix – Aircraft Delivered to Royal Navy, ADM 116/5813.

Table 14. Aircraft production, 1944 ¹³³

British production	Type	Quantity
	Barracuda	1272
	Swordfish	429+
	Seafire	800
	Firefly	287
	Walrus	3+
	Sea Otter	138
	Firebrand	20
Total		<u>2949</u>
American production	Avenger	217
	Corsair	1461
	Hellcat	601
	Wildcat	233
	Non-operational trainers	430
	Communication aircraft	131
	Non-operational helicopters	41
	Miscellaneous	55
Total		<u>3149</u>
Overall Total		6098

+ Walrus production ceased January 1944, Swordfish production ceased August 1944

The most interesting statistic to come out from between Table 9 and 14 was that while British aircraft production had tripled in 1942-1944, American production was over seven times what it had been two years previously and had overtaken the British effort in overall terms. Thereby, despite the failure to meet individual targets American production was the key ingredient in enabling naval air expansion to proceed. The figures do not tell the story of the operational utility of the aircraft. When it came to the navy’s most sustained air operations in 1945, the Avenger, Corsair and Hellcat were the aircraft of choice, the Barracuda being replaced in squadrons of the British Pacific Fleet in November 1944 and the Seafire only being used because not enough Hellcats were available to replace them.

The decision in mid-1944 that first line expansion should peak at a lower strength at an earlier date caused the Fifth Sea Lord to contact the British Admiralty Delegation in Washington, with the monthly requirements of thirty-three Avengers, eighty Corsairs and twenty-five Hellcats during the first six months of 1945 to meet the new target of 1800

aircraft on 1 October 1945.¹³⁴ The reply in October 1944 was not encouraging with a total of only eighty Avengers, 316 Hellcats and no Corsairs available in this period.¹³⁵ In the event the actual production was far more generous with 240 Avengers, 230 Corsairs and 316 Hellcats supplied to the Royal Navy up the end of the war against Japan in which they played a key role.

Failure of British aircraft manufacturing

A major difficulty faced with the production of naval aircraft in Britain during the Second World War was the dependence on only a few manufacturers. Fairey's was the leading naval aircraft manufacturer during the inter-war years, especially in the 1920s when Sir Richard Fairey was in personal charge. However, by the late 1930s the senior staff were not of the same calibre and the firm was unable to cope with orders in wartime: '...there was no other firm so well qualified to design FAA types as Faireys. On the other hand, their production efforts were disastrous.'¹³⁶ The Swordfish was never mass produced and did not need any jigging or tooling and when the firm tried to put the Albacore into mass production serious difficulties were encountered. Fairey's position was not helped by the MAP which firstly restricted materials to the firm and then insisted on too many programme changes; the factory at Hayes went from Swordfish to Albacore to Firefly and that at Stockport from Battles to Fulmars to Barracudas.

One of most serious failures of an aircraft company during the war occurred at Fairey's in 1942.¹³⁷ In the spring of that year the full extent of the disaster which had befallen the Barracuda programme became clear when Ernest France, in charge of a section of Fairey's Design Department at the Stockport works, wrote to Alexander, the First Lord, over the actions of one of his colleagues:

'A person [Mr de Lisser] holding a position of some responsibility has informed me that, last Friday, he wrote to two Members of the House (Keyes and Sueter) giving them a great deal of inconvenient although accurate information concerning the present position and past progress of the machine [Barracuda] referred to above.'¹³⁸

¹³³ Notes on naval air matters for information of Ministers by Air Branch, 19 Feb 1945, ADM 1/17399.

¹³⁴ Message from Fifth Sea Lord to Head of BAD, 23 Sep 1944, ADM 1/16414.

¹³⁵ Message from Naval Air Representative, BAD to Fifth Sea Lord, 29 Oct 1944, ADM 1/16414.

¹³⁶ Interview with Commodore Slattery, CNR, 25 Jun 1943, AVIA 46/136.

¹³⁷ Keith Hayward, *The British Aircraft Industry* (Manchester: Manchester University Press, 1989), 23.

¹³⁸ Letter from Ernest France to First Lord, 16 Mar 1942. ADM 1/12575.

De Lisser had revealed that despite three and a half years of design work, the aircraft was still unsatisfactory in flight trials and there would be a considerable delay before it would be in mass production. Three days later France was interviewed by Colonel Neville, Assistant Director of the Naval Intelligence Division, to investigate the claims and this meeting revealed inestimably more devastating evidence of the Barracudas failings:

‘As an example of the muddles which have been made, France told me that the trouble with the flaps and tailplane was discovered and reported as a result of Wind Tunnel tests. Nothing, however, was done to correct the defect until it again became apparent when the prototype was in trial... production will always be bad because, owing to faulty design, the machine is all “bits and pieces” and is thus difficult to manufacture and maintain. France considers that this is largely due to the inefficiency of the man who has been in charge of the design of the Barracuda.’¹³⁹

Admiral Lyster, the Fifth Sea Lord, was unable to refute any of De Lisser or France’s criticisms when he reported on the matter to Alexander, but also pointed out the other organisations with responsibility for delays to the Barracuda; namely the War Cabinet Defence Committee (Supply) for not giving the Barracuda priority earlier in the war, the subsequent production suspension by the MAP between June and September 1940 and the Air Ministry’s unilateral decision of September 1939 not to proceed with production of the original engine, the Rolls Royce Exe, leading to a six month delay before the re-designed version with the Merlin engine was approved.¹⁴⁰ In fact after the interviews Neville was much more concerned about the future of Barracuda production than pressing his investigation further: ‘Both France and de Lisser impressed me most favourably and are genuinely anxious to produce constructive proposals to improve matters. The urgent need for action is only too apparent...’¹⁴¹

A detailed report by De Lisser in April 1942, forwarded to Lyster by Neville, highlighted some of the bizarre specifications which had hampered the design from the start:

¹³⁹ Letter from Assistant Director of Intelligence Division to First Lord, 19 Mar 1942, ADM 1/12575.

¹⁴⁰ Minute from Fifth Sea Lord to First Lord, 20 Mar 1943, ADM 1/12575.

¹⁴¹ Minute from Assistant Director of Naval Intelligence to Director of Naval Intelligence, Mar 1942. ADM 1/12575.

‘Barracuda specification contained the ridiculous requirement that it must be possible to fold and unfold the wings when the machine is suspended from a crane. This is entirely impracticable... a seaplane chassis were also demanded.’¹⁴²

Bearing in mind the instability of the aircraft in service, de Lisser was able to reveal serious shortcomings of early design decisions:

‘At this time [end of 1939] the Chief Designer etc. began to take a full interest in T.S.R. with unfortunate results. Since the calculated centre of gravity of the machine was too far forward, the front fuselage was shortened by six inches and the rear fuselage was lengthened by six inches and other measures taken to move the centre of gravity back. This was a ridiculous decision bearing in mind that the c.g. [centre of gravity] was estimated not measured...’¹⁴³

Alexander himself was similarly unimpressed with progress when he visited Fairey’s factory at Hayes:

‘The history of the design, development and production of the Barracuda has, as you know, been one of continual disappointment... Some time ago I visited Hayes myself to see how things were progressing and, although I am bound to admit that any views formed as a result of such a visit can only be superficial, the impression with which I came away was not very favourable to the management of the firm.’¹⁴⁴

Combined with its infamous reputation in service, the Barracuda’s production nightmare qualifies it for the title of one of the worst aircraft ever to fly under the White Ensign. At the sixteenth general meeting of Fairey Aviation Company on 3 April 1945, the Chairman, Mr A.E. Wright reported:

‘A year ago to-day, the Fairey Barracuda torpedo-bomber, which your company is manufacturing in large numbers for the Royal Navy came into the news with a highly successful attack on the German battleship Tirpitz...In the same month, but on the other side of the world, the Barracudas made a devastating attack at Sabang. These two operations themselves indicate the widespread and diverse degree of

¹⁴² Report ‘Design of TSR aircraft at Fairey Aviation Co’ by K.A. de Lisser, 1 Apr 1942. ADM 1/12575.

¹⁴³ Ibid.

¹⁴⁴ Letter from First Lord to Minister of Aircraft Production, 11 Apr 1942. ADM 1/12575.

requirements by the Admiralty which we are proud to have met effectively...Very large numbers of Barracudas have gone into service...'¹⁴⁵

The report of this meeting has been inserted into the Record Book of 814 Squadron which was equipped with Barracudas in 1944. Next to the above comments, two observations have been added 'At least we are glad that somebody makes something out of them.' and 'Are you kidding.' which seem to sum up the aircrews' view on this aircraft rather well.¹⁴⁶

Shortly after the inquiry over the Barracuda, the prototype Fairey Firefly crashed on 26 June 1942 causing a serious delay in production so only nineteen aircraft were produced in 1942 and 107 in the first six months of 1943. As a result three further orders had to be placed for Albacore spares which took 1,769,500 man hours to complete, the equivalent to eighty Firefly aircraft.

The continuing failures of Fairey's production were graphically highlighted by Admiral Laurence, CNR, in a report to Admiral Dreyer, CNAS, in November 1942: '...there are four ingredients in the production of aircraft, namely, material, machine tools, labour and efficient factory management... Faireys are supplied with the sufficiency of the first three ingredients. Nothing has held up the production of the Barracuda and the Firefly except inefficient management.'¹⁴⁷ Dreyer compared this with the rather better situation when he was Director of Naval Ordnance in the First World War: '...I found myself in the happy position of having engineer inspectors at all the firms from which we were getting gun mountings... and inspectors of steel at all the firms from which were getting guns and ammunition. Thus, all the time I... had my hand on the pulse of each of these firms...'¹⁴⁸ The MAP eventually took decisive action appointing an industrialist, Mr Marden, as its representative at the company. In addition the Fairey Co-ordinating Group was formed in December 1942 to bring together the Fairey Aviation Company, General Aircraft Limited and Aero Engines Limited and 600 sub-contractors in an attempt to remove production bottlenecks.¹⁴⁹ The appointments of individual naval overseers at aircraft factories, in a similar manner to Dreyer's previous experience began in the spring of 1943, with Acting Commander P.L. Mortimer being first in post at Fairey's factory at Hayes.¹⁵⁰

¹⁴⁵ 814 Squadron Record Book, July 1944 – Nov 1945, 202, ADM 207/12.

¹⁴⁶ Ibid.

¹⁴⁷ Minute from CNR to CNAS, 27 Nov 1943, ADM 1/14010.

¹⁴⁸ Letter from CNR to First Sea Lord, 29 Nov 1942, ADM 1/14010.

¹⁴⁹ Notes of meeting held by Sir Ernest Lemon, 9 Dec 1942, AVIA 9/42.

¹⁵⁰ Confidential Admiralty Fleet Order 645, 1 Apr 1943, ADM 1/14010.

However, this was by no means the end of Fairey's problems. Commodore Slattery, CNR, was scathing at Fairey's inefficiency regarding the Firefly programme in a letter to Alexander, the First Lord, in November 1943:

'Fairey's failure to make their [Firefly] programme last week is reported to be due to a shortage of ailerons but it might equally well have been due to a shortage of almost anything else; by that I mean that the planning at Hayes is still so chaotic that if it is ailerons this week it will probably be rudders next week and elevators the week afterwards, and so on to the end of the year... I regret that I can only say that until this firm is put on a proper basis there can be no confidence in the Firefly programme.'¹⁵¹

Alexander, the First Lord, conveyed details of the continuing difficulties, now a rather tiresome burden, to Stafford Cripps, the Minister of Aircraft Production: 'I know Slattery has been talking to you about the continued failure of production at Fairey's Hayes factory. It is hardly possible to estimate what the Navy have suffered in this war from the unending shortcomings of this Works.'¹⁵² Having been involved in the first attempt to reorganise Fairey's in 1942 with the appointment of Marden, Cripps was sympathetic to Alexander's complaint, but believed things were not as bad as the navy was making out:

'I am very conscious of the difficulties with this firm but the present output – or lack of it – is not merely a question of inefficient production. There have been some very difficult technical problems and the sub-contract position at General Aircraft has also been chaotic. I think Marden has done an excellent job and the affair is now 4/5 straight. The worst part is Hayes; the Barracuda production is now going well.'¹⁵³

Cripps blamed poor relations between the Chairman, Sir Richard Fairey and Marden for slowing down the rebuilding process and reported that he had selected the industrialist Clive Baillieu to be appointed Chairman to complete the job, this time without any interference from Fairey. The disarray of the navy's largest aircraft manufacturer four years into the war demonstrates the extreme frustration it had to bear by depending on British companies. The full impact of Fairey's failure can be seen from the following table:

¹⁵¹ Letter from CNR to Secretary to the First Lord, 18 Nov 1943, ADM 1/15003.

¹⁵² Letter from First Lord to Minister of Aircraft Production, 20 Nov 1943, ADM 1/15003.

¹⁵³ Letter from Minister of Aircraft Production to First Lord, 23 Nov 1943, ADM 1/15003.

Table 15. Forecasts of deliveries of Barracudas and Fireflies until the end of 1943¹⁵⁴

Date of forecast	Barracuda	Firefly
December 1941	2070	850
July 1942	1748	799
November 1942	1314	515
January 1943	625	239

The navy had attempted to get a new range of aircraft companies involved in naval work, but with little success as a report from the Aircraft Supply Council noted in August 1943:

‘However, despite every effort to bring new Firms in on the work, it appears that the Navy may remain largely dependent on Faireys and Blackburns. The reasons for this are two-fold. Firstly some of the firms... find themselves too busy with current commitments. De Havillands is a very good example of this. Secondly Faireys and Blackburns, with their long years of experience... have such a much better grasp of the problems to be solved that they seem to put in the more attractive designs – on paper.’¹⁵⁵

Blackburns had successfully improvised to establish a factory near Leeds to produce the Swordfish when Fairey’s began production of the Albacore at Hayes:

‘...the Leeds-Sherburn group for production of the Swordfish, a remarkable example of how capacity can be organised out of holes and corners. The capacity is made up of garages, locomotive shops, etc. and they are capable of producing 55 Swordfish a month, plus 40 per cent spares.’¹⁵⁶

But the experience with the Blackburn Firebrand was hardly one to inspire confidence in the company.

Indeed the evidence that the Admiralty’s patience had expired was visible from the details of the Future Aircraft Programme in August 1944. Aircraft manufacturers were divided between first and second class firms; the former comprised Vickers (Weybridge), Vickers (Supermarine), A.V. Roe, Hawker, Bristol, De Havilland, Handley-Page and Shorts while the latter consisted of Fairey, Armstrong Whitworth, Airspeed, Westland, Miles, Boulton-Paul, Saunders-Roe, English Electric, Blackburn and Gloster. As Head of

¹⁵⁴ Minute from Minister of Aircraft Production for D.C.(S) (43) 3rd meeting, 4 Jan 1943, ADM 1/14873.

¹⁵⁵ Extract from Aircraft Supply Council report 14/43, 3 Aug 1943, AVIA 46/136.

Air Branch remarked: ‘...the Admiralty may expect to be much better served than hitherto, because instead of our having to rely almost entirely on Faireys and Blackburns, who are graded as “Second Class”, we are likely to have at our disposal some of the capacity of other firms who are rated as “First Class.”’¹⁵⁷ In these circumstances it was hardly surprising that the navy was more than happy to place an extensive reliance on American capacity.

Dependence on American aircraft production

In a report on 11 February 1944 the Head of Air Branch assessed the main reasons for the FAA’s dependence on American aircraft production.¹⁵⁸ Firstly, Naval Staff requirements for aircraft types had radically altered as the war progressed as a result of combat experience and the tactical uses for which carriers were used. The major difficulty for the British naval aircraft industry was that most of the changes resulted in a requirement for increased production of single-seater fighters, the type in which British production was unquestionably weakest. For example, as the FAA came increasingly into contact with land-based aircraft in the Mediterranean, a high performance interceptor was needed to defend the Fleet. In April 1942 Admiral Somerville, C-in-C Eastern Fleet, demanded more fighters to supplement his Martlets and Hurricanes and announced that he was going to increase the fighter complement carried by his three Fleet Carriers.¹⁵⁹ The Far Eastern experience led to the proportion of fighters being increased at the expense of TBR’s. The operational decision to use CVEs to provide fighter cover for amphibious landings in the Mediterranean led to a considerable number of ships being equipped with fighters only. The FAA had no choice but to depend on American fighters given the failure of new British types to meet their specification, crucially the complete non-appearance of the Fairey Firebrand the only specific naval single-seater fighter under development in Britain during the early years of the war:

‘While the production plans formulated towards the end of 1942 and at the beginning of 1943 were not altogether unsatisfactory as such, very severe disappointments were experienced in the achievements of British production in

¹⁵⁶ Interview with Commodore Slattery, CNR, 25 Jun 1943, AVIA 46/136.

¹⁵⁷ Minute by Head of Air Branch, 10 Nov 1944, ADM 1/17395.

¹⁵⁸ Report from Head of Air Branch to A.C.N.S. (Air), 11 Feb 1944, ADM 1/16408.

¹⁵⁹ Michael Simpson, ed, *The Somerville Papers: Selections from the Private and Official Correspondence of Admiral of the Fleet Sir James Somerville, GCB, GBE, DSO* (Aldershot: Navy Records Society, 1995), 404.

1942 and 1943... it became clear during 1943 that the Firefly and Firebrand would not prove suitable for the functions for which they were intended.'¹⁶⁰

Fortunately the American Martlets, Hellcats, Corsairs were of high quality and filled the role admirably. Of 6330 American aircraft supplied, 4232 were single-seaters. In comparison the 2100 Seafires was by far the largest production run for a British single-seater, but the ninety-minute endurance and weak undercarriage emphasised the comparative failure of British production; more Seafires were lost as a result of deck-landing accidents in the Pacific than all other causes put together.

Secondly, the British aircraft industry proved unable to increase its capacity to meet the navy's demands, mainly because of: '...the view of higher authority that R.A.F. needs were more urgent...' ¹⁶¹ both in the critical early phase of the war during the Battle of Britain and later with the strategic bombing offensive on Germany. There was also a lack of manpower and resources, which affected the entire British war effort. It took about eighteen months for new British production capacity to come on line and therefore it was unable to respond effectively to the rapidly developing air expansion programmes. Hence it was accepted at an early stage that if the Americans were to supply a large number of CVEs then they should also provide a large percentage of the aircraft to equip them. Nor was there a possibility of British manufacturers producing a large surplus of any type as occurred with the Corsair, albeit under somewhat fortuitous circumstances.

Conclusion

Ironically just at the end of the Second World War the future for British naval aircraft procurement looked promising for the first time in many years as Geoffrey Till explained:

'The operation of aircraft like the Mosquito and Spitfire 21 from carriers in 1944, the construction of such aircraft as the Hawker Sea Fury and Sea Hornet, and the carrier landing of the world's first naval jet fighter, the British de Havilland Vampire in 1945, all showed in the end that given adequate support British naval aircraft could compare very favourably with the world's best land or sea-based aircraft.'¹⁶²

¹⁶⁰ Statement 'Fleet Air Arm – Aircraft Requirements and Production Arrangements since Outbreak of War' by Air Branch, Feb 1944, ADM 1/16408.

¹⁶¹ Report from Head of Air Branch to ACNS (Air), 11 Feb 1944, ADM 1/16408.

¹⁶² Till, *Airpower and the Royal Navy*, 109.

However in terms of those aircraft in front line service it is difficult to disagree with Ian Cameron's rather damning assessment: 'Between the first day of the war and the last, the Fleet Air Arm received not one single British aircraft which wasn't either inherently unsuited to carrier-work or was obsolete before it came into service.'¹⁶³ What was not in doubt was that the arrangements which had existed in the inter-war period seriously hampered the navy's ability to conduct a successful procurement strategy and as Geoffrey Till noted this took several years to put right: 'By the end of the Second World War the Navy had built up a strong body of technically minded officers and had re-established the close links with both the American and British aircraft industries which it had enjoyed in the First World War.'¹⁶⁴ Indeed the contrast with the excellent relations enjoyed by the RNAS with manufacturers between 1914-1918 and the world class aeroplanes, airships, seaplanes and flying boats which they produced is enormous and clearly demonstrates the need for a coherent procurement process. The FAA was extremely fortunate that American aircraft were not only provided in large numbers, but were also generally of excellent quality. This allowed it to expand to a size which otherwise would have been impossible and to conduct its operations with a considerably greater degree of effectiveness.

¹⁶³ Ian Cameron, *Wings Of The Morning: The story of the Fleet Air Arm in the Second World War* (London: Hodder & Stoughton, 1962), 16.

¹⁶⁴ Till, *Airpower and the Royal Navy*, 103.

Chapter 5 – Operations and Co-ordinating Resources

Overview

The operational tasks of the RNAS in the First World War were extremely diverse with different resources required for each situation. Seaplanes from seaplane carriers operated with the Grand Fleet. Seaplanes and non-rigid airships were responsible for anti-submarine patrols in home waters in the early years of the war and aeroplanes were employed for the air defence of Britain. The deployment of seaplanes, aeroplanes and kite balloons to the Dardanelles also opened up new possibilities, as Churchill observed in April 1915: ‘...The possibility of working a squadron or squadrons of aeroplanes from an overseas base had not been foreseen; this operation was now being carried out with great success, and has materially altered preconceived ideas as to the means of employment of aircraft.’¹

Initially in World War I the RNAS had few restrictions placed on the types of operations it conducted. Pre-war planning encompassed support for the Grand Fleet and anti-submarine patrols from the stations on the East Coast. However within a few months the air defence of Britain, reconnaissance for the army and long range bombing had been undertaken. The changing leadership at the Admiralty also had a significant impact on how its airpower was utilised, with an emphasis on strategic bombing in 1916. There was little need to considerably prioritise resources until 1917 when increased requirements on the Western Front, for coastal anti-submarine patrols and Grand Fleet aviation put a strain on the supply of pilots.

The Fleet Air Arm’s experience in theory should have been restricted to ship-based operations according to the terms of the Inskip award in 1937 under which the RAF retained control of Coastal Command.² The reality was rather different and the lack of carriers until 1943 saw the employment of squadrons with Coastal Command and in army-co-operation roles. The navigational skills which naval crews utilised for flying over the sea were employed in the Western Desert where they flew pathfinder missions for the Desert Air Force. The need to use carriers for ferrying aircraft, especially in the Mediterranean also put pressure on the few available carriers.

The large-scale expansion required during wartime put serious pressure on operational effectiveness as some squadrons were disbanded to provide cadres of new squadrons and in later years to enlarge existing units. When large numbers of American-built CVEs, ordered for the Battle of the Atlantic, entered service they were required for

¹ Minutes of conference on aircraft, 3 April 1915. ADM 1/8433/270B.

² Letter from Minister for Coordination of Defence to Prime Minister, 21 Jul 1937, CAB 21.526.

many more roles; for example providing fighter cover for amphibious landings and transporting aircraft, especially from the USA. As a result some squadrons equipped for anti-submarine operations were on the sidelines for long periods. The large-scale expansion of the FAA in 1943 was accompanied significant changes in its organisation to enable it to conduct more substantial operations than hitherto.

The First World War

Fleet operations

Of the original operations earmarked in 1914 considerable problems were encountered with the provision of support for the Fleet because of the fragility of seaplanes, but substantial progress was made on a number of operational issues. Seaplane carriers needed to be fast enough to keep station with the fleet and Sueter requested such a ship as early as 14 August 1914.³ The ex-Cunard liner *Campania* was duly converted in 1915. Another significant development was the first take off by an aeroplane from a carrier when a Bristol Scout took off from *Vindex*'s flying off deck on 3 November 1915.⁴

However, the replacement of the dynamic Fisher and Churchill regime at the Admiralty with the conservative Arthur Balfour and Henry Jackson in 1915 followed by the appointment of an officer with no air experience, Rear-Admiral Vaughan-Lee, to the post of Director of Air Services, heralded a period when naval aviation lacked innovation and urgency. The new regime also lacked the respect of many in the RNAS as Lieutenant Isaac recalled in December 1916:

‘The naval airmen have no confidence in the Air Board while Admiral Vaughan Lee and the Third Sea Lord [Rear Admiral Tudor] are there to represent the Admiralty. Neither of these officers is an airman, nor either even taken any interest in, nor given any encouragement to the development of aviation...’⁵

One result of this leadership change was that in July 1915 air stations were placed under the command of the Commander-in-Chief of the local naval district rather than under the direct command of the Director of Air Services in the Admiralty: ‘The Royal Naval Air Service is to be regarded in all respects as an integral part of the Royal Navy, and in future the various Air Stations will be under the general orders of the Commander-in-Chief of Senior Naval

³ Minute by DAD, 14 Aug 1914, AIR 1/631/17/122/36.

⁴ Report by CO, HMS *Vindex*, Nov 1915, ADM 1/8432/253.

⁵ Report from Lt Isaac to Major Baird, New Air Board, Dec 1916, 3, IWM/Doc 99/75/1.

Office in whose district they are situated....’⁶ This meant that development in operational procedure was not uniform across the service.

The lack of urgency was most evident regarding fleet aviation. For example, Admiral Jellicoe had first raised the use of kite balloons on ships in mid-1915, but it was not until October 1916 that an establishment was approved for use with the Grand Fleet. Trials on *Engadine* with the Battle Cruiser Fleet in October 1915 convinced Beatty that kite balloons could largely negate the advantage hitherto possessed by the High Seas Fleet in terms of reconnaissance.⁷ The resistance remained within the Admiralty which highlighted the difficulties of air balloon operation:⁸

‘It is not considered possible to keep inflated balloons bagged down on deck, and there are two alternatives. The first is to carry the necessary hydrogen and inflate the balloon just when it is required. The draw back to this is the hydrogen is very explosive and takes up a lot of room. The second is for each ship to receive its Kite Balloon from shore or a Depot Ship before leaving harbour...’⁹

However, Major Baird of the Air Board placed the blame for lack of progress squarely on the Admiralty’s shoulders:

‘It has taken the Admiralty 41 days to decide to refuse to give us what we asked for, namely:- “any recent Reports from Admiral Sir John Jellicoe on the subject of Kite Balloons...” we cannot be responsible for recommending an air policy unless we are in possession of Admiral Jellicoe’s views. What we do know is that in spite of the reports dated June and October, 1915, both of them laying stress on the great value of kite balloons, our Fleet is still groping about in the dark and relying apparently exclusively on valuable Light Cruisers to do its scouting.’¹⁰

The Admiralty informed Beatty in January 1917 that the equipping of Light Cruisers with balloons was limited by production of winches, totalling twelve per month.¹¹ However, between 16 March - 29 October 1917, balloons were used by the Grand Fleet on no fewer than 159 occasions on ships and once from the submarine K5, their availability no longer

⁶ Admiralty Weekly Orders, 29 Jul 1915, ADM 1/632/17/122/71.

⁷ Report from Vice Admiral, Battle Cruiser Fleet to Secretary of Admiralty, 31 Oct 1915, AIR 1/636/17/ 122/ 131.

⁸ Letter from Secretary of Admiralty to C-in-C, Home Fleet, 1 Sep 1915, AIR 1/636/17/122/138.

⁹ Memorandum on ‘Naval Kite Balloon Service’ from Secretary of Admiralty to Secretary of Air Board, 24 Aug 1916, AIR 2/127.

¹⁰ Minute by Major Baird, Air Board, 29 Aug 1916, AIR 2/127.

restricted by resources: 'Demands on the Air Department for personnel and material for Grand Fleet services largely in excess of anticipated requirements have been promptly met.'¹²

When Admiral Beatty became C-in-C Grand Fleet he appointed a Committee to report on the fleet's air requirements which recommended improvements in a number of operational spheres including reconnaissance using flying boats and more integral reconnaissance and fighter aircraft for the fleet.¹³ As Beatty noted:

'...our present aerial arrangements for the Grand Fleet are inadequate, the more so when it is considered that the German High Sea Fleet is amply provided with Zeppelins and a squadron of six seaplane carriers. The recently joined seaplane carrier "Manxman" had proved to be totally unfit for service with the Battle-Cruiser Fleet owing to the lack of speed.'¹⁴

Aeroplanes were also used to equip capital ships and cruisers with Beatty's full support: 'Every effort should be made... to develop the use of naval aircraft for fleet purposes in every possible respect.'¹⁵ In December there were seventy-four two-seaters and 107 single-seaters in service with the Grand Fleet and as the number of ship borne aircraft increased in 1917 it was also proposed to employ the obsolete seaplane carriers, *Engadine*, *Riviera* and *Empress* in a ferrying role to supply aircraft to the ships of the Grand Fleet at Scapa Flow.¹⁶ The aeroplanes could be maintained in good condition in their workshops until they were deployed onto the warships.

In 1918 the majority of naval air squadrons at Dunkirk were transferred to the control of the Commander-in-Chief, BEF, and for the first time since 1914 the RNAS devoted its full attention to maritime aviation. This included a proposal for an attack on the High Seas Fleet in Wilhelmshaven with torpedo aircraft. The development of the aeroplane torpedo-bomber was suggested in September 1916 and the prototype flew in June 1917, but only ninety delivered by Armistice despite Beatty's repeated complaints.¹⁷ If the Admiralty had afforded a higher priority to maritime aviation in 1916-1917 it is highly likely that this aircraft would have been available in greater quantities. Efforts continued to get more

¹¹ Letter from Secretary of Admiralty to C-in-C Grand Fleet, 7 Jan 1917, AIR 1/636/17/122/131.

¹² Report from Vice Admiral Commanding, Second Battle Squadron to C-in-C Grand Fleet, 3 Nov 1917, AIR 1/661/17/122/651.

¹³ Report from Committee of Royal Naval Air Service to Rear Admiral Commanding, Fifth Battle Squadron, 26 Jan 1917, AIR 1/648/17/122/382.

¹⁴ Letter from C-in-C Grand Fleet to Secretary of Admiralty, 11 Jan 1917, AIR 1/651/17/122 447.

¹⁵ Letter from C-in-C Grand Fleet to Secretary of Admiralty, 21 Jan 1917, ADM 1/8478.10.

¹⁶ Report by Air Division, 13 Feb 1918, AIR 1/308/15/226/188.

aircraft to sea and by the end of the war each capital ship had a 1½ Strutter for reconnaissance and a Sopwith Camel to engage Zeppelins. The air establishment of the Grand Fleet had risen to 388 aircraft and 204 pilots, four carriers and thirty-seven other air capable ships, a far cry from the paucity of resources which had attended fleet aviation two years before.¹⁸

Coastal Patrolling and Convoy Escort

The need for coastal patrols in the North Sea was one of the first tasks apportioned to naval aircraft before 1914. The threat posed by the U-boat became apparent in late 1914 and from early 1915, as described in Chapter 4 a large fleet of non-rigid airships were successfully developed by the navy forming the backbone of anti-U-Boat patrols. While the airships were not particularly effective at sinking U-boats their deterrent effort was considerable. The increasing airship effort during the war can be seen from the table below:

Table 16. Summary of hours flown by airships, 1915-1918¹⁹

Station	1915	1916	1917	1918 (1 Jan – 31 Oct)
Anglesey	20	1193	1559	3982
Barrow (Constructional)	60	54	20	17
Caldale	-	70	346	-
Cranwell (School)	-	-	825	3924
East Fortune	-	289	2212	3966
Folkestone	101	1144	1912	6370
Howden	-	504	2132	4770
Kingsnorth (Constructional)	16	750	211	400
Longside	-	440	1310	4207
Luce Bay	35	405	1757	4432
Mullion	-	360	2889	7936
Pembroke	-	343	2349	4767
Polegate	107	1252	2985	7921
Pulham	-	158	1847	632

¹⁷ Letter from C-in-C Grand Fleet to Admiralty, 30 Jul 1918, AIR 1/643/17/122/257.

¹⁸ Paper from Rear Admiral Sir R. Phillimore to Committee of the Navy League, April 1920, IWM/Doc 96/33/1-4.

¹⁹ Development of Airship Service, 1914-1918, AIR 1/726/122/3.

(Experimental)				
Wormwood Scrubs (Constructional)	-	116	35	230
Total	339	7078	22389	53554

As can be seen patrols around the coast of Britain were greatly expanded in 1917-1918. At the beginning of 1917, the airship stations at Longside, East Fortune, Howden, Pulham, Mullion and Pembroke all possessed their authorised complement of coastal airships for the first time and were able to implement a systematic scheme of patrols could be established so there were no gaps between the patrols of the various stations. With the start of the convoy system in April, airships were employed on convoy escort duties while seaplanes and flying boats were used for patrols, although they could be called-in by airships to make an attack.²⁰ The Channel bases were afforded top priority for resources; for example in February 1917 no 240hp Short seaplanes were available for South Shields seaplane station in the north-east.²¹

With the resumption of the unrestricted U-boat campaign in 1917, a greater emphasis was placed on operations in home waters and efforts re-doubled in the anti-submarine war which was transformed with the introduction of Large America flying boats with their six hour endurance paving the way for the famous Spider Web anti-submarine patrol diagram in the Channel and similar patrols in the Western Approaches and the Irish Sea. The Spider Web patrols from Felixstowe began on 13 April 1917 and in the first eighteen days, twelve of which were flying days, the five flying boats available made twenty-seven patrols sighting eight U-boats and bombing three. More resources were needed especially at Killingholme which in April 1917 had only one Large America, which was due for overhaul, two Short seaplanes, both out of action and six Baby Sopwith seaplanes, four of which were fitted with incorrect propellers. To carry out its duties successfully six Porte boats, twelve Large Americas and six Baby Sopwiths were requested.²² In addition flying boats were to be used in an anti-Zeppelin role as the Operations Division noted in April 1917: ‘...it is desired to use the Large Americas and other seaplanes at Felixstowe, Yarmouth and Killingholme to attack hostile airships which may approach the East Coast during daylight hours while engaged in reconnaissance trips

²⁰ Development and Operations of the RNAS in Home Waters: Part II – Submarine Campaign, 1917-1918, AIR 1/677/21/13/1902.

²¹ Minute by DAS, 21 Feb 1917, AIR 1/656/17/122/549.

²² Letter from Rear Admiral Commanding, East Coast of England to Secretary of Admiralty, 26 Jun 1917. AIR 1/639/17/122/185.

over the North Sea.’²³ Following interception of German radio transmissions flying boats shot down L22 on 14 May and L43 on 14 June 1917. Figures are available from the Portsmouth Group to illustrate the co-ordinated anti-submarine effort in 1917:²⁴

Table 17. Anti-Submarine patrols conducted by the Portsmouth Group, 1917 ²⁵

Anti-Submarine Patrols	No. of Patrols	Hours	Mileage
Seaplanes from Calshot, Bembridge, Newhaven, Portland & Cherbourg	1540	3515	213584
Airships from Polegate	406	1822	43649
Kite Balloons from Tipnor	29	1239	14341
Total	1975	6576	270954

The average seaplane patrol lasted for 2.2 hours compared with 4.4 for airships and 42.7 for kite balloons. Wing Commander Bigsworth, CO Portsmouth Group, praised the effort Polegate Airship Station commanded by Flight Commander Ivon Fraser: ‘...this Airship Station apparently being considerably above any other Airship Station in the Royal Naval Air Service in the number of patrols carried out, and mileage flown during the period.’²⁶ Bembridge’s performance was also singled out for a high intensity of operations despite the availability of only a few seaplanes.

By January 1918 there were 291 seaplanes including about fifty flying boats and twenty-three aeroplanes for anti-submarine patrols. Fifty-four non-rigids airships and a number of kite balloons were allocated for convoy escort. As sixty per cent of U-boat losses occurred within ten miles of the coast flights of DH6 aeroplanes were allocated to this role as an interim measure.²⁷ Overall the anti-submarine operations were an impressive achievement and a full appreciation can be gained from the work of John Abbateillo.²⁸

²³ Minute by DOD, 25 Apr 1917, ADM 1/8485/78.
²⁴ Group comprised RNAS Calshot, RN Seaplane Station Lee-on-Solent and sub stations at Bembridge, Portland, Newhaven (from 11 May) and Cherbourg (from 26 Jul), RN Airship Station Polegate (from 23 Jul) and RN Balloon Section Tipnor (from 28 Sept).
²⁵ Report from CO, Portsmouth Group to DAS, 2 Dec 1917, AIR 1/659/17/122/609.
²⁶ Ibid
²⁷ Letter from Vice Admiral, East Coast of England to Secretary of Admiralty, 3 Mar 1918, ADM 1/8517/70.
²⁸ J.J. Abbateillo, ‘British Naval Aviation and the Anti-Submarine Campaign.’ Ph.D. Diss (King’s College London, 2004).

Operations in France

The deployment of naval aircraft on the continent was certainly not one which had been foreseen before the outbreak of war. However, Commander Samson’s Eastchurch Squadron accompanied the Royal Marines to Belgium in 1914 and after the Allied retreat ended up being based at Dunkirk. Nor did the RNAS on the continent confine itself purely to the use of aircraft and it developed armoured car squadrons, armoured trains and anti-aircraft units as shown by the following table:

Table 18. RNAS personnel, May 1915 ²⁹

	Officers	Men
Air Service	594	4225
Armoured Cars	194	2250
Armoured Trains	13	100
Anti-Aircraft Corps	84	1464
Total	885	8039

In June 1915 the RNAS’s activities were rationalized and the armoured cars, trains and anti-aircraft corps transferred to the Army.³⁰

Two months later an establishment for Dunkirk and Dover was approved, for six squadrons at the former and two at the latter; each squadron comprising six machines, six pilots, four observers and four spare machines. At that time there were two squadrons at Dunkirk and on completion of another two squadrons at Dover they would relieve the two at Dunkirk and such an exchange would take place every month, but the overall establishment would not be achieved in the immediate future:

‘At present owing to the shortage of officers – five Pilots and forty ratings having recently been sent to the Dardanelles – this organisation cannot be fully worked to, but in view of the great importance attached to a vigorous Aerial offensive on the Belgian Coast, it is hoped that these... might be replaced as early as possible.’³¹

²⁹ Statement of Personnel of RNAS, 29 May 1915, AIR 1/2562.
³⁰ Register of the Commission’s Memorial at Arras, 18 Mar 1930: Part II – Air Services, AIR 1/677/21/13/1891.
³¹ Letter by CO, RNAS Dover to Vice Admiral, Dover Patrol, 20 Aug 1915, AIR 1/629/17.120/20.

By the end of September the two squadrons at Dover were ready to go to Dunkirk and another two, Nos 5 and 6 Squadrons, were being formed, but required more officers and Petty Officers:

‘It is considered most desirable to maintain four squadrons at Dunkirk in order to maintain a thoroughly effective coast patrol, and at the same time to have sufficient machines and pilots to protect the fleet from hostile aircraft attacks and also to carry out the bomb attacks against the enemies [sic] gun positions...’³²

In November 1915 four squadrons of six pilots were estimated as necessary for Dunkirk for operations over the winter months, but it was clear that Lambe, the Commanding Officer at Dover, had considerably greater ambitions for the following year:

‘...with the large number of Pilots now being trained in England, and the vastly improved types of Aeroplanes which may be expected, a far more vigorous offensive policy as regards Aeroplanes can be undertaken in the Spring of 1916... and it may be confidently anticipated that successful attacks will be possible on German soil...’³³

The Admiralty gave approval for two more landing grounds to be established at Dunkirk, but laid out guidelines for the use of the aircraft:

‘It must be... understood that the inland work of the Royal Naval Air Service is to be for the training of personnel in contact with the enemy. The units stationed at these two Aerodromes may be regarded as available in connection with Military operations at times when Naval Air work proper is not required to be carried out.’³⁴

By 1916 Dunkirk’s duties encompassed patrolling the Channel to safeguard BEF shipping, attacking submarine bases in Belgium, spotting for bombardments of German installations on the Belgian coast and raiding the Channel end of the German lines on the Western Front, freeing French aircraft for the Battle of Verdun. On 1 May 1916, there were 111 aircraft at Dunkirk and this rose rapidly to 250 by 15 August.³⁵

³² Letter from CO, RNAS Dover to Vice Admiral, Dover Patrol, 11 Sep 1915, AIR 1/629/17/120/20.

³³ Letter from CO, RNAS Dover to Vice Admiral, Dover Patrol, 16 Nov 1915, AIR 1/629/17/120/13.

³⁴ Letter from Secretary of the Admiralty to Vice Admiral, Dover Patrol, 13 Dec 1915, AIR 1/629/17/120/13.

³⁵ First Lord’s RNAS fortnightly returns, 1916, AIR 1/150/15/113/2&3.

The major problem, as explored in Chapter 2, was that the navy had a rather liberal attitude to what was 'naval air work'. Dockyards, arsenals and other installations involved in naval productive capacity had been regarded legitimate targets for the RNAS since early in the war. The Navy was better placed to attack German military installations on account of its monopoly on high-powered engines required for large bombers; indeed the only long distance air raids, on Cologne, Cuxhaven, Dusseldorf and Lake Constance, had been conducted by the RNAS.³⁶

The RNAS's most controversial deployment of the war was that of No.3 Wing to Luxeuil in northern France in 1916. The major battle between the RNAS and RFC revolved around which organisation would carry out long-range bombing and thereby have first call on large aircraft and engines. There was also discontent within the Admiralty at the perceived failure of defensive air operations as the Second Sea Lord noted in February 1916: 'The defensive use of seaplanes and aeroplanes is daily showing itself to be of little value and it is open to grave doubts whether we are wise in spending more money on expensive coast stations.'³⁷

The Admiralty's investment in its offensive policy was perhaps most manifest when it took the unilateral decision to deploy No.3 Wing to Franco-German border to support the French bombing offensive against German industry. Aware of certain RFC opposition, Vice Admiral Oliver, Chief of the War Staff proposed on 5 April 1916: 'Possibly the simplest way of doing it would be to say nothing on this side [of the Channel], but make arrangement with the French and then do it.'³⁸ It was this wholly unsubtle strategy that the Admiralty chose to adopt despite the fact that the navy still retained the secondary role of air defence of the UK and the establishments of home stations would have to be reduced to provide enough pilots. At the end of May Oliver reiterated that since it was a combined operation, 200 miles from the British front, the Army's permission was not necessary. The deployment of No.3 Wing was delayed by the need to meet RFC requests for aircraft, but pressed ahead nevertheless. By February 1917 no fewer than ninety-five 'Class I' aeroplanes were based there with a further fifteen in transit out of total in the RNAS of 336.³⁹

Even before the War Cabinet ruled that the operations of No.3 Wing should cease, the first naval squadron reinforced the RFC on the Somme in October 1916 and another

³⁶ Minute from DAS to COS, 17 Feb 1917, ADM 1/8449/39A.

³⁷ Minute by Second Sea Lord, 25 Feb 1916, ADM 1/8449/39A.

³⁸ Roskill, *Documents Relating*, 344.

³⁹ First Lord's RNAS fortnightly returns, 1-15 Feb 1917, AIR 1/150/15/113/1.

four squadrons followed three months later.⁴⁰ Pilots for these squadrons were taken from Luxeuil, coastal and air defence stations in Britain plus the Eastern Mediterranean.⁴¹ The remainder of No.3 Wing was withdrawn in the spring of 1917 to provide reinforcements for squadrons operating on the Western Front where losses were heavier than on naval operations. Some pilots found themselves almost exclusively employed on land operations and Wing Commander Bell-Davies VC who served at Dunkirk, the Dardanelles and with No.3 Wing noted in early 1917:

‘I had volunteered for aviation because I thought it would be useful in [the] naval war; but with the war in its third year I had never even seen the Grand Fleet. We had worked with ships in Gallipoli, indeed, but they had really been acting only as floating batteries in support of the Army.’⁴²

In one way the RNAS was unfortunate in its timing since two months after the withdrawal of No.3 Wing, the German Gotha raids on London took place and the independent bombing missions against targets in Germany were firmly back on the agenda, the Handley Pages of the RNAS providing the backbone of this force. It is interesting that the Admiralty regarded the bombing of German steel works as a legitimate naval target, but the support of the RFC on the Western Front as an unwanted distraction. There is an interesting juxtaposition with the situation during the Second World War when the RAF insisted that the strategic bombing of Germany was a top priority and therefore initially refused to allocate long range aircraft to Coastal Command for the Battle of the Atlantic. On the other hand the enforced disbandment of No.3 Wing in April 1917 forced the navy to concentrate on its maritime priorities.

Operations in the Mediterranean

The Mediterranean remained a low operational priority throughout the war. The recommendations of Wing Captain, formerly Colonel, Sykes, RFC, on the resources necessary to support forces at Gallipoli were not accepted and allocations of heavy bombers to target Constantinople were frequently promised, but not delivered.

In October 1915 Sykes reported that if aircraft were provided on a similar ratio to the Western Front, then 168 aircraft were required to support the thirteen divisions on

⁴⁰ Development and Operations of the RNAS in Home Waters: Part III – Belgian Coast Operations, 1917. AIR 1/677/21/13/1930.

⁴¹ Minutes of Air Board’s Thirtieth meeting, 11 Dec 1916, ADM 1/8449/39A.

Gallipoli. The priority was for more aeroplanes so that seaplanes could be used more effectively: '...as specialist and costly craft they should not, when avoidable, be used for work, which aeroplanes could carry out equally well. Hitherto it has been unfortunately necessary to use seaplanes for such work.'⁴³ General Headquarters, Eastern Mediterranean requested a further two Wings, a total of 120 aeroplanes and two seaplane carriers, the suggestion being that aircraft could be withdrawn from home stations. The reality was that approval was given for an establishment of only fifty aeroplanes, nineteen seaplanes, three airships and three kite balloons.⁴⁴

With the withdrawal from Gallipoli, no great expansion of the RNAS's presence was likely; an aeroplane wing at Imbros, an Airship Base at Mudros, two seaplane carriers and two kite balloon ships. No.2 Wing would be brought up to a strength of three squadrons by the transfer of some personnel and material from No.3 Wing, the remainder of which would return to Britain.⁴⁵

The provision of heavy bombers for the Eastern Mediterranean demonstrated the relatively low priority afforded to the theatre. The basis of the request was the supposed impact of bombing Constantinople: 'Intelligence reports... indicate that service of great material value to Allied cause in the East would result from heavy bombing of Constantinople and that ill feeling between Turk and German already strong would be much intensified.'⁴⁶ Four Handley Pages were allocated to the British Aegean Squadron in October 1917, but were diverted to France. A signal was then received from the Admiralty on 20 October: 'Six Caproni bombers will shortly be delivered and orders are being issued for them to be flown to Otranto.'⁴⁷ Within a week the promise of the Capronis was also withdrawn. The question re-surfaced in March 1918 when the Air Ministry signalled that due to the independent bombing programme over Germany and operations against German submarine bases no Handley Pages were available until May or June. In lieu six DH9's were due to be sent out at the end of March. Nos 144 and 146 Squadrons were due to complete working up in June before being sent to the Aegean, but the C-in-C Mediterranean was informed on 21 June that were going to the Middle East and No.4 Naval

⁴² R. Bell-Davies, *Sailor in the Air: The Memoirs of Vice Admiral Richard Bell-Davies* (London: Peter Davies, 1967), 158.

⁴³ Report from Wing Captain Sykes to VA, EMS, 21 Oct 1915, AIR 1/654/17/122/503.

⁴⁴ Minute to First Lord, 20 Nov 1915, AIR 1/654/17/122/503.

⁴⁵ Letter from Wing Captain RNAS, EMS to VA, EMS, 9 Jan 1916, AIR 1/649/17/122/420.

⁴⁶ Message from RNAS Mudros to Fifth Sea Lord, 17 Oct 1917, AIR 1/673/17/134/40.

⁴⁷ Message from ADOD to C-in-C Mediterranean, 20 Oct 1917, AIR 1/673/17/134/40.

Group respectively.⁴⁸ Throughout the war the navy provided only the minimum of forces necessary to maintain operations in the Mediterranean.

The Crisis of 1917

There were major developments in a number of areas of naval work in 1917; sufficient seaplanes, airships and especially flying boats became available to enable systematic anti-submarine patrols around Britain's coast for the first time. In addition aeroplanes were first employed from cruisers and capital ships of the Grand Fleet. Therefore there was a renewed emphasis on the naval aspects of the RNAS's roles when its support for the Army was most needed.

The losses suffered by naval squadrons operating with the RFC were far greater than those suffered by units in naval roles. In January 1917 the Director of Air Services gave the Army squadrons priority: '...the provision of fighting squadrons asked for to assist the Army in the field should take precedence of the personnel and machines for No.3 Wing...'⁴⁹ but it was clear that this decision was not made willingly: 'Squadrons operating with the B.E.F. in the Field, a purely Military operation in no way connected with the Navy. This latter operation has been undertaken with reluctance by Their Lordships, not being a Naval Operation, and is due to the urgent representation of Field Marshal Sir D. Haig...'⁵⁰

By the end of March, Nos 1, 3, 6, 8 and 10 Squadrons were operating with the RFC. It was impossible to provide for these squadrons from the resources of the Dunkirk command alone; machines and pilots from home and Mediterranean stations were withdrawn, bombers were removed from No.3 Wing at Luxeuil and converted into fighters while twenty Sopwith 1½ Strutters allocated for Romania were also requisitioned for use on the Western Front.⁵¹ The remaining squadron was removed from Luxeuil on 15 April and its aircraft and machinery were to be handed over to the French. In August 1915 there were only twenty pilots at Dunkirk, by August 1916 this had risen to sixty and the prediction for August 1917 was 298.

Between January - March 1917 pilot wastage in the Dunkirk command was 10.1% per month and 15.2% for April. April 1917 was the RFC's worst month of the whole war and earned the title 'bloody April'. Naval squadrons were deployed in advance of their

⁴⁸ Letter from Secretary of Admiralty to C-in-C Mediterranean, 21 Jun 1918, AIR 1/649/17/122/406.

⁴⁹ Minute by DAS, 24 Jan 1917, ADM 1/8449/39A.

⁵⁰ Minute by DAS, 30 Jan 1917, ADM 1/8478/10.

usual training programme to take part in the Battle of Arras and therefore had not built up the requisite experience of air gunnery and formation flying. Therefore it would require sixty pilots per month to maintain its complement of 300.⁵² Captain Lambe had requested 267 additional pilots by the end of July and despite the arrival of 281, squadrons were still below strength and further action was necessary.

Some pilots were withdrawn from anti-submarine stations in south-west England in the summer of 1917, but this was not enough and there followed a progressive rationalisation of squadrons on the Western Front. First the number of pilots per squadron were reduced from twenty to eighteen and later fifteen. Then Nos.6 and 11 Squadrons were disbanded in August and No.9 Squadron withdrawn the following month to maintain Nos 1, 8 and 10 Squadrons up to strength. Nos.1 and 10 Squadrons were subsequently withdrawn from RFC service in November, leaving only No.8 Squadron in the army co-operation role.⁵³

Intensive operations on the Western Front coincided with an increase of inshore anti-submarine patrols in February 1917, especially in the Western Approaches, the introduction of the 'Spider Web' patrol pattern in the English Channel in April and the employment of aeroplanes from cruisers and capital ships of the Grand Fleet. Therefore late in 1917 fifty per cent of the pilots graduating from Cranwell were needed for anti-submarine patrols and twenty-five per cent for the Grand Fleet.⁵⁴ As Jellicoe recognised in August 1917: 'It must be recognised that it is one thing to lay down policy, and another, quite a different one, to carry it out after three years of war, when difficulties of every sort connected with the supply of labour and material are met with in every direction...'⁵⁵ The difficulty of prioritising resources in 1917 when there were a number of competing operational demands presaged frequent such crises in the Second World War.

Second World War

Wartime expansion and a shortage of resources

The FAA was faced with an immediate difficulty given its small size and the operations it was expected to undertake. In addition some experienced squadrons were disbanded to provide cadres for new squadrons as part of the FAA expansion programme and to supply

⁵¹ Development and Operations of RNAS in Home Waters: Part III – Belgian Coast Operations, 1917, AIR 1/667/21/13/1930; Minutes of Air Board's 30th meeting, 11 Dec 1916, ADM 1/8449/39A; Minute by DAS, 31 Dec 1916, AIR 1/651/17/122/460.

⁵² Letter from CO, RNAS Dunkerque to Vice Admiral, Dover Patrol, 8 May 1917, AIR 1/660/17/122/662.

⁵³ Development and Operations of RNAS in Home Waters: Part III – Belgian Coast Operations, 1917, AIR 1/667/21/13/1930.

⁵⁴ Ibid.

reinforcements to the units operating in the Mediterranean. Captain Larcom, DNAD, made clear his opposition to the decommissioning of existing squadrons in December 1939: 'We have already had experience of the ill effects of splitting up Squadrons haphazard[ly]... The advantages of practising what we preach are the more marked in the present case, because 815 (after some early misadventures) is being worked up systematically under Naval direction ashore...' ⁵⁶ The majority of aircrew were from 811 Squadron who had survived the sinking of HMS *Courageous* and the life of this famous squadron began inauspiciously: '...great difficulty was experienced in obtaining the necessary stores and equipment... No flying was carried out for the first fortnight, owing to the lack of equipment to make the machines serviceable.' ⁵⁷ At the outbreak of war Norrie Martin was serving as a Flight Commander in 810 Squadron on HMS *Ark Royal*. In January 1940 the ship returned to Britain for refitting and the squadron lost many aircrew to provide an experienced cadre for new squadrons: 'All our pilots were highly trained and we had only one fatal accident during the whole South Atlantic operations. The squadrons were decimated on our return to England, and a large number of our best pilots were taken away to form new squadrons for the brand new carriers that were coming into commission.' ⁵⁸

In May 1940 Martin was appointed CO, 821 Squadron, based at Hatston in the Orkneys and again served on *Ark Royal*. However in November 821 was disbanded and its aircraft were sent as reinforcements to the Middle East while the pilots were absorbed by other squadrons. Due to the need to reinforce Malta, 821 and 823 Squadrons were disbanded on 30 November 1940 and the twelve best aircraft transported to Gibraltar in HMS *Argus*.

During the Norwegian campaign Vice Admiral Wells, Vice Admiral, Aircraft Carriers complained that he lacked sufficient front line squadrons to exchange those disembarked. As a result squadrons were overused and a number of aircrew relieved after suffering from stress and Captain Moody, DNAD, admitted that a policy to form supernumerary squadrons was abandoned in 1938 on cost grounds. ⁵⁹ For the ill-fated attack on the *Scharnhorst* at Trondheim in July 1940 the number of aircraft to be employed was limited by the number of pilots with previous dive-bombing experience. ⁶⁰ Pilot Donald Gibson of 803 Squadron complained that: '...most of the experienced pilots at dive-

⁵⁵ Admiralty Air Policy, Appendix I by First Sea Lord, 23 Aug 1917, AIR 1/677/21/13/1901.

⁵⁶ Minute by DNAD, 7 Dec 1939, ADM 1/10738.

⁵⁷ 815 Squadron Diary, 1939-1941, Entry for Oct 1939, ADM 207/13.

⁵⁸ W.H.N. Martin, *Memoirs*, 30, IWM/Doc 98/1/1.

⁵⁹ Report from Vice Admiral, Aircraft Carriers to Secretary of Admiralty, 20 Aug 1940, ADM 199 847 & Minute by DNAD, 25 Oct 1940, ADM 199/847.

⁶⁰ Minute by DNAD, 11 Jul 1940, ADM 199/840.

bombing had by then been killed or taken prisoner and most of the pilots in the squadrons were people like myself who were straight out of flying schools and when I was actually in the dive I had... four Messerschmitts on my tail.’⁶¹

The use of limited forces, due to scarcity of resources, continued into 1941. Only one carrier was usually available in the Mediterranean and at the Battle of Matapan in March 1941, HMS *Formidable* had only fourteen strike and thirteen fighters available which placed a heavy strain on the available crews.⁶² By 12 May her fighter complement was down to four and on the day she was hit, 25 May, it was only twelve. Most famously in the hunt for the *Bismarck*, HMS *Victorious* was hurriedly equipped with nine Swordfish from 825 Squadron and six Fulmars from 800Z; for some of the Fulmar observers it was their first time in a two-seat aircraft and their aircraft did not possess homing beacons.⁶³ Nor were these squadrons properly worked up. 828 Squadron, equipped with Albacores, was fully operational and serving in the Orkneys, but the local AOC Coastal Command would not release it in time.⁶⁴

When talks took place in November 1942 about the possibility of reinforcing the US Pacific Fleet which had been reduced one operational carrier Admiral Cunningham insisted that sufficient forces should first be allocated to Operation ‘Torch’: ‘I feel it is of primary importance not to reproduce the situation we had in 1941 in [the] Eastern Mediterranean when, owing to carrier losses, we had neither a sea borne nor a shore based air striking force with the results of which we are aware.’⁶⁵ The results which Cunningham referred to were the serious losses during the evacuation from Crete when nine major warships were sunk and a further fifteen damaged.

The relatively small-scale of the FAA’s operations until a large number of carriers became available in 1943 and a misconception over naval air operations resulted in an amazing attack by Churchill in July 1943 who complained that the FAA was not suffering *enough* casualties; there had been only thirty killed, missing or prisoners in the three months up to 30 April out of a total strength of 45,000: ‘We cannot however keep such a large mass of high-class personnel of the highest quality in a condition of non-activity so far as actual contact with the enemy is concerned.’⁶⁶ Rear Admiral Portal, Assistant Chief

⁶¹ D.C.E.F. Gibson, IWM/SA 9696, Reel 1.

⁶² Report from CO, HMS *Formidable* to Rear Admiral, Mediterranean Aircraft Carriers, 10 Apr 1941, ADM 199/781.

⁶³ Despatch from C-in-C Home Fleet to Secretary of Admiralty, 27 May 1941, ADM 199/838.

⁶⁴ David Brown, *Carrier Operations in World War II: Volume 1 The Royal Navy* (London: Ian Allan, 1968),

22.

⁶⁵ Message from NCXF to Admiralty, 20 Nov 1942, PREM 1/363/1.

⁶⁶ Minute from Prime Minister to First Lord, 23 Jul 1943, ADM 1/14990.

of the Naval Staff (Air), rebutted Churchill's criticism using the extremely pertinent example of the Grand Fleet in the First World War:

'In Naval air work periods of spectacular activities and achievements alternate with periods of dull routine, mainly comprising intensive training and the normal operations of escort and patrol... the value of the force cannot be assessed on positive and visible achievement over a particular period. If that were so it could be said that the Grand Fleet achieved little over a protracted period of the last war but none the less the German Fleet surrendered.'⁶⁷

Admiral Boyd, the Fifth Sea Lord, reported that between September 1939 - June 1943 the average monthly casualty rate of flying personnel in operational units was 2.04%. The worst period was the quarter ending 30 June 1940 when there were 105 casualties out of 819 aircrew, a monthly loss rate of 4.53%, coinciding with the Norwegian campaign and the loss of HMS *Glorious*. This was closely followed by the next three months when 115 out of 900 became casualties, a loss of 4.46% per month. The 220 casualties during these six months amounted to twenty per cent of the 1051 casualties over the whole period and were clearly unsustainable.⁶⁸

Boyd highlighted the FAA's three major roles; firstly, engaging enemy surface units which resulted in the destruction of the *Bismarck* and the successes at Taranto and Cape Matapan. Secondly, in convoy work, especially to Malta, Russia and the major role in the Battle of the Atlantic and thirdly, supporting land operations including those in North Africa and Syria where successes were offset by the disasters in Greece and Crete. In the long term he predicted that the FAA would be the navy's main striking force when significant operations were undertaken in the Far East and Pacific.⁶⁹

Availability of fighter squadrons

While a number of strike squadrons were broken up to provide cadres for new squadrons or reinforcements, the situation regarding fighter squadrons was desperate. The pre-war assumption that carriers would not have to engage land-based aircraft resulted in their being only four naval fighter squadrons in 1939, in comparison with twelve strike squadrons. One further fighter squadron formed in 1939, four in 1940, eight in 1941, thirteen each in 1942, 1943 and 1944 and five in 1945, but the extensive training

⁶⁷ Draft letter from ACNS (A) to Prime Minister, 16 Aug 1943, ADM 1/14990.

⁶⁸ Report from Fifth Sea Lord to First Lord, Table D, 30 Aug 1943, ADM 1/14990.

⁶⁹ Report from Fifth Sea Lord to First Lord, Section I, 30 Aug 1943, ADM 1/14990.

programme and slow aircraft construction programme took time to come fruition. Overall fifty-seven fighter squadrons were formed during the war compared with only thirty-three strike squadrons.⁷⁰

Such was the situation even in 1943 that when the decision was taken that the FAA should play a significant role in providing cover for amphibious landings, the navy requested that some RAF Spitfire squadrons be trained in carrier techniques and their aircraft modified, in case it became necessary to rotate squadrons during intensive action. The Assistant Chief of the Air Staff (Operations) informed the Chief of the Air Staff of the navy's requirements at the end of 1942: 'The Naval Staff now state that their requirement in Spitfire aircraft and Spitfire pilots for this operation will be about 140, and the time that they will be required for shipping for embarkation for the operation would be about the 1st March.'⁷¹ A lack of any firm operational commitments saw the scheme proceed slowly. The Director of Operations at Fighter Command reported on 13 June that he doubted any of the crews would ever be used action and due to the dislocation caused by the training programme, recommended the scheme should be abandoned: 'We were aiming at training 100 pilots. Up to date a total of 59, including one Squadron Commander and four Flight Commanders, have completed this training satisfactorily... Since we initiated this training I have heard nothing more whatever as to whether these pilots and the arrester gear are ever likely to be used.'⁷²

By the time of a meeting between the Vice Chiefs of the Naval Staff and Air Staff held on 4 November 1943 100 pilots had been trained. At this meeting the requirement was reconsidered and provision for 200 RAF pilots and their aircraft to operate from carriers at three months notice was agreed.⁷³ Discussions between the Assistant Chief of the Air Staff (Fighters) and the Assistant Chief of the Naval Staff (Air) and the Fifth Sea Lord on 23 October brought an interesting new revelation of the Admiralty's plans for their employment:

'...the 200 pilots will be required for Far Eastern operations about the end of 1944, Captain Moore [Plans Division] pointed out that this commitment is not a definite one, but was put forward... if it was thought that maximum effort ought

⁷⁰ See Appendix 2 for details of the formation of squadrons between 1939-1945.

⁷¹ Letter from ACAS (Ops) to CAS 16 December 1942, AIR 20/845.

⁷² Minute from DF Ops to ACAS (Ops), AIR 20/845.

⁷³ Agenda for meeting between VCAS and ACAS on 'Training and equipment of R.A.F. fighter pilots to operate from carriers', AIR 20/845.

to be switched to the Far East with the least possible delay after the collapse of Germany.’⁷⁴

While the air cover for amphibious operations in 1943-1944 did not require employment of reserve squadrons and hence the RAF pilots were not employed operationally, it demonstrated the FAA had few fighter reserves. It also raises the obvious question of why did the Navy not press for the transfer of RAF pilots, in the knowledge that their use was a feasible proposition. In the Pacific the FAA was seriously short of pilots and RAF aircrew would have only required a deck landing training programme, rather than the full aircrew training schedule.

Shore-based operations, 1939-1943

The pre-war planning for the FAA had been based around the carrier construction programme and RAF Coastal Command was tasked with providing shore-based maritime reconnaissance and strike capability. However, as Head of Air Branch commented in March 1942 this was not adhered to: ‘By the Cabinet decision of 1937, the operation of shore based first line squadrons was reserved to the Air Ministry, but this ruling has been departed from on more than one occasion during the present war.’⁷⁵

The lack of carriers in service until 1943 resulted in a number of FAA squadrons being employed ashore, especially in the Mediterranean. 830 Squadron arrived at Malta as early as June 1940 and joined by 828 Squadron in October 1941 were a thorn in the side of Axis convoys. Aircraft from 830 Squadron sank thirteen ships totalling 68,000 tons in 1941 alone. Many FAA squadrons which operated in the Mediterranean were put ashore from damaged carriers. 815 Squadron armed with Swordfish had a splendid record of action after disembarking from *Illustrious* operating from Greece, Crete, the Western Desert and Cyprus in 1941. It was an excellent example of FAA resourcefulness and squadron mobility; for example when operating in Cyprus the squadron was supported from Dekheila in Egypt.⁷⁶ Some squadrons spent a considerable time ashore after unplanned disembarkations; 826 Squadron left *Formidable* in May 1941 and spent the next two and a half years either in the Western Desert or at Malta before disbanding in October 1943. 803 Squadron had an extremely varied career abroad serving in Egypt from May - June 1941 and Syria from June - August. It then became part of the RN Fighter Squadron in the Western Desert from August 1941 - February 1942 before moving to Ceylon in March and

⁷⁴ Minute from ACAS (F) to VCAS, 23 October 1943, AIR 20/845.

⁷⁵ Minute by Head of Air Branch, 2 Mar 1942, ADM 1/16412.

embarking in *Formidable* and then *Illustrious* between April - December. A further deployment followed in East Africa from December 1942 - August 1943 before the squadron was eventually disbanded.⁷⁷ It appears some squadrons abroad were allowed to continue until their equipment was effectively exhausted in the case of 828 and 830 Squadrons in Malta.⁷⁸

The FAA's duties may have been even more extensive as Churchill, then First Lord, proposed in January 1940 that the FAA should take over all of Coastal Command's duties in the North Sea so: '...the Fleet Air Arm, which then, and then alone, would have a task proportioned to its cost, and worthy of its quality.'⁷⁹ To achieve this, eight squadrons would have been withdrawn from carrier duties. Bearing in mind that the FAA had only twelve strike squadrons at the outbreak of war this would have been impossible. In August 1942 the navy proposed to increase the employment of FAA aircraft with Coastal Command in the UK from two to five squadrons: 'It would be much appreciated if 812, 816 and 833 Squadrons each with 6 Swordfish could be accommodated at one or more of your stations and employed under the same terms as 811 and 819 Squadrons as from 7th September.'⁸⁰ The difficulty in converting US CVE's was the reason for the availability of spare squadrons: 'There are now several fully trained F.A.A. Squadrons, with no carriers, due to the delay in the American conversions. It is proposed that some of these should be employed in the Channel for attacks on "E" boats etc on the lines of 841 Squadron.'⁸¹

By mid-1943 CVE's were becoming available in much greater numbers, as will be discussed later in this chapter, and the need for more aircraft to man them led to a heated debate in the Admiralty over the continued support for Coastal Command. Captain Lambe, the Director of Plans, was in no doubt that carriers should have top priority:

'In the past we have felt bound to acquiesce... [to shore-based squadrons] in NORWAY, CRETE, SCAPA (A/S patrols), MADAGASCAR, the CHANNEL and above all the MEDITERRANEAN where we have been filling a gap for over two years in spite of frequent efforts to withdraw our squadrons for their proper duties... almost every local authorities... attempted to use our reserves for carriers so painfully accumulated at strategic points. The fact that we have as yet suffered no major set back resulting from an inadequate supply of squadrons for

⁷⁶ 815 Squadron Diary, 9 Oct 1940 - 2 Dec 1941. ADM 207/13.

⁷⁷ Information from relevant squadron entries in Ray Sturtivant and Theo Ballance, *The Squadrons of the Fleet Air Arm* (Tonbridge: Air Britain, 1994).

⁷⁸ Minute by DNAD, 28 July 1942. ADM 1/11742.

⁷⁹ Minute from First Lord to First Sea Lord, 19 Jan 1940, ADM 1/14990.

⁸⁰ Message from RANAS to AOC-in-C, Coastal Command, 26 Aug 1942, ADM 1/11742.

⁸¹ Minute by DACD, 27 Aug 1942, ADM 1/11742.

carriers has resulted from a combination of carrier casualties and tactical needs which we can only regard as fortuitous.’⁸²

Captain Wright, DAWT, proposed a far more pragmatic approach: ‘...it is foolish to let it become a rigid law hampering our own operational freedom... We may dislike seeing aircraft carriers empty, but it is clearly our duty to place squadrons ashore under the Royal Air Force and accept empty carriers if our operational conscience decrees this to be the correct course of action.’⁸³ Captain Eccles, DOD (H), recommended that six Swordfish or Albacores be available to each the Nore, Portsmouth and Plymouth commands to cover East Coast and Channel convoys.⁸⁴ In the event in the autumn of 1944 no fewer than seven squadrons, four Swordfish and three Barracuda, were still operating under Coastal Command.⁸⁵ The FAA had also provided a number of shore-based squadrons to cover the D-Day landings in 1944, although this was a one-off for such a critical operation, rather than part of wider pattern of employment.

Ferrying of RAF aircraft, 1940-1942

One use which the RN certainly did not envisage in the inter-war period was the need to reinforce RAF forces overseas through the use of carriers. The Norwegian Campaign sent the tone when *Furious* carried RAF Gladiators & Hurricanes across the North Sea and later *Glorious* transported No.263 Squadron to Lake Lesjaskou.

The most significant operations were those for the reinforcement of Malta and to Takoradi in West Africa. Malta presented a unique problem, an unsinkable aircraft carrier it may have been astride Axis supply routes from Italian ports to Libya, but it was also very difficult to support logistically. The majority of the aircraft for the island were delivered via aircraft carriers and no fewer than 700 were delivered from thirty-three carrier trips between August 1940 and October 1942.⁸⁶ As the numbers suggest the effort was considerable with Force H escorting eleven ferrying trips to Malta between April - November 1941. Between March - July 1942 a further ten trips were made delivering 275 Spitfire for the defence of Malta, although it must be remembered that these were written off at an average rate of seventeen per week. A trip by Fairey Albacores in March 1942 highlighted the difficulty of making such a flight with inexperienced aircrews:

⁸² Minute by D of P, 21 Jun 1943, ADM 1/16412.

⁸³ Paper by DAWT, 12 Jun 1943, ADM 1/16412.

⁸⁴ Minute by DOD (H), 12 Jun 1943, ADM 1/16412.

⁸⁵ Minute by D of P, 25 Nov 1944, ADM 1/18576.

⁸⁶ Unpublished notes on Staff History of British Naval Aviation, 1919 – 1945, Volume III, Appendix II A’ NHB. Two trips were made by USS *Wasp*, the remainder by carriers of the Royal Navy.

‘With the exception of [the] senior pilot and senior observer the crew of Albacores have had no first line experience, pilots have never flown off nor landed on [a] carrier, observers have done practically no night navigation and night wind finding and are inexperienced wireless operators. Consequently I am not very happy about their ability to fly off and navigate to Malta in dark.’⁸⁷

The British carriers *Argus*, *Ark Royal*, *Eagle* and *Furious* made the majority of the journeys, but their limited availability and capacity resulted in USS *Wasp* making two trips in 1942. Churchill sent a telegram to President Roosevelt appealing for the loan of *Wasp*:

‘Malta can only now muster 20 or 30 serviceable fighters. We keep feeding Malta with Spitfires in packets of 16 loosed from Eagle.... This had worked a good many times quite well but Eagle is now laid up for a month... we estimate that *Wasp* could take 50 or more Spitfires... a powerful Spitfire force could be flown into Malta at a stroke and give us a chance of inflicting a severe and possibly decisive check on the enemy...’⁸⁸

To provide the American carrier with expertise on ferrying operations and the Spitfire aircraft, HMS *Eagle*’s Commander Flying and Lieutenant Commander Air Staff plus three RAF officers and an RAF Flight Sergeant were flown from Britain to Gibraltar to sail on *Wasp*.⁸⁹ In all forty-seven Spitfires accompanied by thirty-four RAF officers, two Warrant officers, thirty-two Flight Sergeants and Sergeants, eighteen Corporals and seventy-nine aircraftmen embarked on *Wasp*.⁹⁰ The Spitfire Mk 5Cs flew off 550 miles from Malta and all landed safely on 20 April.⁹¹ The contribution of these trips to maintaining Malta’s resistance astride Rommel’s supply routes cannot be underestimated and carriers were essential to this task.

Italy’s declaration of war also put great strain upon RAF resources in the Middle East. At the time there were only 300 first-line aircraft in the theatre and the most modern fighter was the Gladiator bi-plane.⁹² The defeat of France removed the possibility of reinforcing the RAF in Egypt by flight delivery from Britain. With the Mediterranean effectively closed to merchant ships, except those with a heavy naval escort on vital missions, the easiest option was to transport crated aircraft to the port of Takoradi in West

⁸⁷ Message from SO, Force H to Vice-Admiral Malta, 12 Mar 1942, ADM 223/545.

⁸⁸ Personal telegram from Prime Minister to President, 1 Apr 1942, AIR 8/980.

⁸⁹ Telegram from Admiralty to C-in-C Home Fleet, 4 Apr 1942, ADM 223/549.

⁹⁰ Telegram from Admiralty to C-in-C Home Fleet, 8 Apr 1942, ADM 223/549.

⁹¹ Telegram from VA Malta to SO, Force W, 20 Apr 1942, ADM 223/549.

Africa and then fly them on the 4000 mile route from Egypt via Khartoum. Initial plans in June 1940 called for the monthly supply of forty-five fighters, forty-five medium bombers, and thirty seven other 'planes per month although it was admitted: 'The above figures are calculated on a theoretical basis and do not represent what can be spared or what will actually be consumed.'⁹³ Sections of RAF personnel would be provided at Kano, Geneina and Khartoum where the aircraft would make overnight stops during their four-day trip.

Operation 'Stripe' in November 1940 was one of four crucial trips made by the navy to reinforce the RAF in the Middle East in the early stages of the fighting against the Italians. HMS *Furious* left the Clyde in early November to embark thirty-four aircraft for a ferry trip to Takoradi. The ship retained six Skuas of 801 Squadron, disembarking 801, 816 and 825 Squadrons and associated maintenance personnel and equipment.⁹⁴ The need to ferry Hurricanes with non-folding wings necessitated twenty-two aircraft stored in *Furious*' lower hangar with wings removed; on arrival off Takoradi these aircraft would be assembled in six hours by the forty-five embarked RAF maintenance personnel. The remaining twelve were ranged complete in the upper hangar together with the six Skuas.⁹⁵ *Furious* flew off the thirty-four Hurricanes and three Fulmars on the morning of 29 November. One Hurricane crashed into the sea and the pilot was killed. Six of the RAF aircraft commenced their journey to Egypt by 0940 the same morning, with the remainder following in batches of six at daily intervals.⁹⁶ *Argus* and *Furious* made a total of four trips on this route between September 1940 and March 1941 supplying 142 Hurricane fighters at a crucial stage in the Mediterranean war.⁹⁷

From the spring of 1941 reinforcements became available direct from the United States, the first shipment of 100 Kittyhawk fighters and 20 Maryland light bombers sailing to Takoradi on the Norwegian merchant ship, *Tamerlane*. At this stage of the war one of the major problems was the unavailability of American shipping: 'The whole cargo had to be entrusted to this one vessel, owing to inability to charter other ships. No. U.S. ships can be chartered under present legislation.'⁹⁸ By the autumn there was the prospect of increasing numbers of Kittyhawks and Boston medium bombers being delivered directly from the USA to Red Sea saving on British shipping capacity and ferry pilots. Up to the end of

⁹² Michael Armitage, *The Royal Air Force*, 2nd edn (London: Cassel, 1999), 122.

⁹³ Notes for the Officer Commanding the future RAF Station at Takoradi, 27 Jun 1940. AIR 2/7248.

⁹⁴ Telegram from DOD (H) to C-in-C Home Fleet, 4 November 1940. ADM 223/676.

⁹⁵ Telegram from DNAD to HMS *Furious*, 5 November 1940. ADM 223/676.

⁹⁶ Telegram from RAF Takoradi to HMS *Furious*, 29 November 1940. ADM 223/676.

⁹⁷ Unpublished notes on Staff History of British Naval Aviation, 1919 – 1945, Volume III, Appendix IIB.

NHB.

⁹⁸ Notes on shipment of aircraft and materials supplied to Africa, Mar 1941, AVIA 38/445.

November 1941, 2136 aircraft arrived in the Middle East. Of these 887 came via sea and air via Takoradi, 491 by air, 487 by sea via the Cape and 271 on aircraft carriers.⁹⁹

A final diversion of resources came at the start of the war in the Far East, when the navy's most modern carrier HMS *Indomitable* was diverted to Port Sudan and delivered fifteen Hurricanes to Singapore and thirty-three to Batavia in Java on her first mission¹⁰⁰ and a further fifty aircraft to Ceylon on the second.¹⁰¹ While the aircraft at Singapore and Java could make little difference to the overall result, the Hurricanes formed the backbone of the defences in Ceylon when the island was raided by Japanese carrier forces in April 1942.

Co-ordinating the employment of Escort Carriers, 1942-1944

The issues surrounding the employment of CVE's are particularly interesting because they highlight the difficulties of co-ordinating the use of carriers and the work-up of squadrons when the operational needs of the navy were changing. During 1943, when thirty of the Royal Navy's forty-four CVE's were commissioned, the Battle of the Atlantic, the primary reason for the construction the ships, had declined in importance as measures against the U-boats became increasingly effective and the threat diminished. Henceforth they were deployed on a number of other tasks which were then regarded more important than trade protection.¹⁰²

An excellent example of the unpredictable nature of the war, in which some squadrons were continuously employed whilst others had long breaks between front line action, can be seen from the experience of 835 Squadron, an anti-submarine Swordfish squadron. After working up during the first three months of 1942 the squadron spent twenty months of inactivity apart from one spell afloat in June 1943. The reason was that the squadron was awaiting a CVE for anti-submarine operations when they were being used for other purposes. Then between January 1944 - March 1945 the 835 Squadron was almost continuously afloat, largely on the CVE *Nairana* supporting North Atlantic and Arctic convoys.¹⁰³ Similarly Observer John Neale joined 822 Squadron at the beginning of 1942 and spent a frustrating six months: '...the squadron fretted, flying on exercises when possible, moving to other naval bases at Crail, Donibristle, Machrihanish and Lee-on-

⁹⁹ Minute from DWO to CAS, 19 Dec 1941, AIR 8/942.

¹⁰⁰ Minute from CAS to Prime Minister, 29 Jan 1942, PREM 1/142/1.

¹⁰¹ Minute from Chiefs of Staff to Prime Minister, 24 Feb 1942, PREM 1/142/1.

¹⁰² See Appendix 3 for full details of CVE availability, Aug 1943 - Nov 1944.

¹⁰³ Lieutenant Commander E.E. Barringer, *The 835 Story*, 1-2, IWM Doc 91/17/1.

Solent. Other Squadrons, in the same fix, came and went – 818, 820, 825 – all marking time with no aircraft carriers to work from.¹⁰⁴

The experience of 835 and 822 illustrates the problems encountered by trade protection squadrons at a time when priorities were changing and the squadrons simply had to continue training ashore until ships became available. The cause was the small number of ships available. Consider the situation in February 1941. Of the remaining pre-war carriers, *Argus*, previously used for deck landing training, was in the Clyde preparing to ferry RAF aircraft to Gibraltar, *Furious* was ferrying RAF aircraft to Takoradi in West Africa, *Ark Royal* was serving with Force H in the Western Mediterranean, *Eagle* was operating with Mediterranean Fleet based at Alexandria, and *Hermes* was searching for service raiders in the South Atlantic. Of the new armoured carriers only *Formidable* was available, steaming to replace her seriously damaged sister *Illustrious* in Cunningham's Mediterranean Fleet. There were therefore only four carriers in front line service, with two other on ferrying duties which did not operationally benefit the FAA, although were essential for the war effort. The losses of *Ark Royal* in November 1941, *Hermes* in April 1942 and *Eagle* in August 1942 further exacerbated the FAA's predicament. In addition one of the major problems in expanding an air arm compared with other sectors of a navy can be seen from the figures of the USN calculating the time taken for the personnel to be trained and get into the front line. For a Third Class Electricians Mate serving in the Pacific Fleet the time was thirty-three weeks, a Sonar Officer for a newly commissioned destroyer fifty-one weeks and to a deploy carrier pilot to the forward Pacific area eighty-three weeks.¹⁰⁵

One consequence of the lack of carriers noted in mid-1943 was that the expansion of the FAA was not matched by adequate operational experience of new squadrons. The raids carried out on Norway earlier in the war were now discontinued and accordingly Fighter Command took twenty FAA pilots to give them operational experience.¹⁰⁶ A similar arrangement was agreed for Seafire pilots in March 1944.¹⁰⁷ The need to rush squadrons into action at Salerno in September 1943 meant there was insufficient time for them to work up with their carriers and subsequently it was recommended that should be allowed to work up together.¹⁰⁸ As a result prior to Operation Dragoon in August 1944,

¹⁰⁴ Lieutenant-Commander J. Neale, *The Incredible Stringbag and Me*. (Hailsham: J and K Publishing, 1997), 118.

¹⁰⁵ Eccles, *Operational naval logistics*, 122.

¹⁰⁶ Notes on Fifth Sea Lord's second periodical meeting, 7 Jul 1943, ADM 116/5057.

¹⁰⁷ Notes on Fifth Sea Lord's sixteenth periodical meeting, 29 Mar 1944, ADM 116/5057.

¹⁰⁸ Conclusions of meeting held at Admiralty, 20 Oct 1943, in Appendix A, Report from Staff Officer (Air) to C-in-C Eastern Fleet, 13 Nov 1943, AIR 23/2512.

twenty-eight aircraft and fifty-two pilots from three squadrons of No.4 Wing were attached to the Desert Air Force.¹⁰⁹ A lack of experience was startlingly obvious during Operation 'Tungsten' against the *Tirpitz* on 3 April 1944; of the five types of aircraft, the Barracuda, Corsair and Hellcat had little previous operational use. Three of the four types of bombs had not been used by the FAA before¹¹⁰ and the Captain of HMS *Victorious* recalled that eighty-five per cent of the 650 men of 52 and 47 Wings had never been to sea in a ship before this attack.¹¹¹

The major addition to the RN's carrier strength was the large number of CVEs, but it was not until 1943 when the majority entered service. Three CVEs were commissioned in 1941 followed by six in 1942, thirty in 1943 and seven in 1944.¹¹² Six CVEs were converted in Britain and thirty-eight built in the United States. The peak periods for delivery were August and November 1943 when six vessels were delivered in each month.¹¹³

The big change from the time of ordering the CVE's in 1941 and 1942 and the majority entering service in 1943 was the growing numbers of duties for which the ships were required, in addition to the convoy escort role for which they were originally ordered. HMS *Biter* was the first CVE to commence regular North Atlantic convoy work in April 1943 with four in service by June and seven by the start of 1944. In fact the major burden of trade escort later in the war was undertaken by MAC ships, the first of which *Empire MacAlpine* entered service in May 1943 and no fewer than eighteen by the end of 1943. By the autumn of 1944 there was no requirement for CVEs in the Atlantic.¹¹⁴

¹⁰⁹ Report from CO HMS *Stalker* to C-in-C Mediterranean Station (Naples), 29 Jul 1944, ADM 199/116.

¹¹⁰ Report from Vice-Admiral, Second-in-Command, Home Fleet to C-in-C Home Fleet, 10 Apr 1944, ADM 199/844.

¹¹¹ Report from CO, HMS *Victorious* to Vice Admiral, Second in Command, Home Fleet, 5 Apr 1944, ADM 199/844.

¹¹² Commissioning dates of the Royal Navy's escort carriers were:

1941 UK – *Audacity* 20/06.

US – *Attacker* 30/09, *Archer* 17/11.

1942 UK – *Activity* 29/09.

US – *Avenger* 2/03, *Biter* 6/04, *Dasher* 2/07, *Battler* 31/10, *Stalker* 21/12.

1943 UK – *Pretoria Castle* 29/07, *Vindex* 15/11, *Nairana* 26/11.

US – *Hunter* 9/01, *Tracker* 31/01, *Fencer* 3/01, *Searcher* 7/04, *Chaser* 9/04, *Ravager* 25/04, *Striker* 29/04, *Pursuer* 14/06, *Ameer* 20/07, *Begum* 2/08, *Trumpeter* 4/08, *Emperor* 6/08, *Slinger* 11/08, *Empress* 12/08, *Khedive* 23/08, *Nabob* 7/09, *Shah* 27/09, *Patroller* 22/10, *Atheling* 28/10, *Premier* 03/11, *Ranee* 08/11, *Thane* 19/11, *Speaker* 20/11, *Queen* 7/12, *Ruler* 22/12.

1944 UK – *Campania* 9/02.

US – *Rajah* 17/01, *Smiter* 20/01, *Trouncer* 31/01, *Puncher* 5/02, *Reaper* 18/02, *Arbiter* 06/02.

Information from: David Hobbs, *Royal Navy Escort Carriers* (Liskeard, Cornwall: Maritime Books, 2003).

¹¹³ Aug 1943 – *Begum*, *Trumpeter*, *Emperor*, *Slinger*, *Empress* and *Khedive*.

Nov 1943 – *Premier*, *Ranee*, *Vindex*, *Thane*, *Speaker* and *Nairana*.

¹¹⁴ David Brown, *Carrier Operations in World War II: Vol I: The Royal Navy*, (London: Ian Allan, 1968), 51-52.

In October 1942, Captain Bridge, DNAD, was one of the first officers to suggest that CVE's would have to be improved to encompass the whole range of operational tasks:

'...it is quite certain that, in view of the very inadequate number of Aircraft Carriers available and the time required to build more, these ships will often be used in other than convoy operations. It is therefore essential that they should be equipped with aircraft capable of full offensive (as opposed to defensive) work with the Fleet.'¹¹⁵

A key point was that for CVEs to operate offensively and employ fighters modifications to the ships would be required. The refit of HMS *Battler*, one the first of the American-built CVE's to be significantly altered, took ten weeks and Captain Eccles, DOD (H) commented: '...the importance of these escort carriers is so great at this time. It is possible that we are being too "Rolls Royce" in fitting these ships with modern equipment.'¹¹⁶ Eccles suggested that *Archer*, *Dasher*, *Biter* and *Battler* be modified to operate fighter aircraft and *Attacker*, *Fencer*, *Hunter* and *Stalker* maintained to carry only strike aircraft.

In February 1943 Captain Lambe, the Director of Plans, noted that the tasks CVEs would be expected to perform were providing air cover for amphibious operations and convoys to Russia requiring high performance fighters and on trade routes when aircraft of a lesser performance could be utilised.¹¹⁷ The main alterations to operate fighter aircraft were a longer flight deck and fighter direction facilities taking seven weeks, with all ships requiring increased bomb room protection, taking five weeks, after the loss of HMS *Avenger*.

There was pressure to get the requisite number of ships into the Battle of Atlantic: and Captain Huskisson, DAM, commented: '1943 is certain to be a critical year as far as U-boat warfare is concerned and D.A.M. does not feel justified in laying up vitally needed new Escort Carriers for periods of at least two months if it can be avoided.'¹¹⁸ In addition a critical report by the Allied Anti-Submarine Survey Board of 27 August 1943 was naturally concerned with the employment of the maximum of carriers on trade routes: '...failing a drastic reduction in delay in getting British CVEs into operation consideration be given to the U.S. Navy manning some or all of the next 7 CVEs allocated to Britain with a view to a

¹¹⁵ Minute by DNAD, 17 Oct 1942, ADM 11956.

¹¹⁶ Minute by DOD (H), 18 Jan 1943, ADM 1/14842.

¹¹⁷ Minute by D of P, 7 Feb 1943, ADM 1/14798.

¹¹⁸ Minute by DAM, 17 Feb 1943, ADM 1/14842.

higher proportion of these vessels being employed on A/S operations with the minimum delay.’¹¹⁹

In reply the Admiralty accepted there would have been four more CVE’s in service on trade routes if no alterations had been made but: ‘...there would undoubtedly have been unable to meet unexpected calls for fighter support which we are now meeting in the Mediterranean and in the Indian Ocean early in 1944.’¹²⁰ The Admiralty felt that it had to address its long term priorities: ‘We cannot, just for the sake of some temporary window dressing to please the Americans, allow a large proportion of our carriers to go out to the Eastern war quite unfitted to carry out what will be then most important offensive duties.’¹²¹ The other issue was simply that the U-Boat threat was declining in late 1943 and did not have the priority it once demanded: ‘...with the present decrease, (even if only temporary), of U-Boat activity against Atlantic convoy routes in our zone, and the growing requirement for fighter escort carriers in all spheres, Their Lordships consider that our policy is sound.’¹²² The availability of fighter aircraft were a further limitation on the number of CVEs that needed to be fully converted. Captain Byas, DNAO, noted that in addition to the current complements for *Formidable*, *Illustrious*, *Indomitable*, *Furious* and *Unicorn*¹²³, six CVEs could be equipped with Seafire L.IICs and IICs while leaving: ‘... a reasonable number of fighter squadrons continually disembarked to obtain the training necessary for the various operations.’¹²⁴

However, at the end of August 1943 the Admiralty received news from Tacoma that the rate of CVE construction was accelerating which would result in ships waiting for alteration at Vancouver for up to three and a half months. The British Admiralty Delegation in Washington suggested that a solution was that five unmodified CVEs be allocated to ferrying duties.¹²⁵ Initially there was resistance to this idea with Captain Lambe, the Director of Plans, insisting that unmodified vessels could not act in such a capacity in operational theatres and the Director of the Anti-U-Boat Division wanted them employed on relatively low risk trade routes, for example in the South Atlantic.

By the beginning of October Lambe had substantially changed his view due to a crisis in the aircraft supply situation. Firstly, since August the number of operational

¹¹⁹ Extract from report of Allied Anti-Submarine Survey Board, 27 Aug 1943 in message from BAD to Admiralty, 4 Sep 1943, ADM 1/12857.

¹²⁰ Letter from Secretary of Admiralty to Deputy Secretary, BAD, 7 Sep 1943. ADM 1/12857.

¹²¹ Memorandum by Plans Division, Aug 1943, ADM 1/12857.

¹²² Ibid.

¹²³ Complements were: *Formidable* – 30 fighters, 12-18 T.B.R.; *Illustrious* – 30 fighters, 12 T.B.R.; *Indomitable* – 40 fighters, 15 T.B.R.; *Furious* – 12 fighters, 18 T.B.R.; *Unicorn* – 10 fighters, 18 T.B.R.

¹²⁴ Minute by DNAO, 5 Jun 1943, ADM 1/14806.

¹²⁵ Telegram from BAD to Admiralty, 31 Aug 1943, ADM 1/12857.

aircraft expected in Ceylon by February 1944 had risen by 250%. Secondly, there was insufficient merchant shipping to transport aircraft from the United States and thirdly, the FAA had a lower priority for shipping than the RAF. In the short term the use of CVE's would circumvent the merchant shipping issue and create a supply stream independent of the MAP and the RAF. The backlog in the United States was a particularly thorny issue, since the Americans were unlikely to allocate further aircraft if the current batch was still sitting on Roosevelt Field. There was no time to position reserves for the Far East before the arrival of the fleet, but these would have to arrive in the same phase of operations as the deployment of the Fleet Carriers themselves.¹²⁶ The ships then available for ferrying included the aircraft transports *Athene* and *Engadine*, the captured Italian seaplane carrier *Miragua*, and the operational CVE *Searcher*. The decision to employ *Empress*, *Patroller* and *Ranee* for ferrying to the Indian Ocean was greeted with satisfaction by Captain Caspar John, BAD's Naval Air Representative, in a telegram to the Fifth Sea Lord, Rear Admiral Boyd, on 17 November:

'From experience, I can say without reservation that without these CVEs we should not have got the aircraft to where they are required in time... We are under hot fire from the U.S. Navy regarding the accumulation of aircraft which has resulted from the bad shipping position. Twice already I have been attacked officially with the threat to cut our assignments on the grounds that we cannot get rid of what aircraft we get. I managed to resist the first attack, the second came yesterday.'¹²⁷

At this time there were 310 aircraft at Roosevelt Field awaiting shipment and ferrying in a CVE rather than being sent in crates in commercial vessel had considerable advantages; aircraft could be shipped complete with all their secret components and so did not require such substantial reassembly on arrival. The requirement for CVE transportation was predicted to rise substantially: '...from 5 in the first quarter of 1944 to 13 in the last quarter of 1944. These figures are based on cargo of 60 aircraft in each ship, allowing a round voyage from U.K. to U.S.A. to the Eastern Theatre of 3 months, and a round voyage from U.S.A. to U.K. of 6 weeks.'¹²⁸ This proposal was rejected by Captain Lambe who limited the availability of CVEs to six, the rest being dependent on commercial shipping.

The following table shows the operations undertaken by CVEs in 1944:

¹²⁶ Minute by D of P, 3 Oct 1943, ADM 1/13752.

¹²⁷ Letter from Naval Air Representative, BAD to Fifth Sea Lord, 17 Nov 1943, ADM 1/16342.

¹²⁸ Minute by DNAO & DAE, 18 Nov 1943, ADM 1/16342.

Table 19. Operational tasks undertaken by Escort Carriers, 1944 ¹²⁹

Operational Task	No. of individual operations	% of overall effort
Convoy escort	64	35.9
A/S hunting groups	17	9.5
Support of land operations	23	12.9
Enemy shipping strikes	20	11.2
Minelaying strikes	12	6.7
Ferry service	42	23.5
Search for blockade runner	1	0.3
Total	178	100

As can be seen that only one-third of CVE operations were convoy escort compared with twenty-three per cent on ferrying duties and twenty-four percent supporting land operations and in strikes on enemy shipping. This provides a contrast with Fleet Carrier operations where sixty-two per cent were directed against coastal shipping, largely in Norway and land targets in the Far East:

Table 20. Operations undertaken by Fleet Carriers, 1944 ¹³⁰

Operational Task	Number of operations	Carriers employed – Home Waters	Carriers employed – Far East
Tirpitz	4	10	-
Coastal shipping and land targets	17	12	13
Minelaying	2	2	-
Sweep	2	-	2
Photo Recce	1	1	-
Not known	1	1	-
Total	27	26	15

Not only was increasing requirements competing for resources in 1943-1944, but Captain Lambe, the Director of Plans, predicted a significant change in the geographical distribution of the FAA with forces in the Far East doubling from thirty-one per cent of its strength at the beginning of 1944 to sixty-two per cent at the beginning of 1946.¹³¹

¹²⁹ Memorandum No.132 by Department of Operational Research, 1954, ADM 219/494.
¹³⁰ Report No.6/49 by Department of Operational Research, 1949, ADM 219/344.

Review of squadron organisation, 1943-1944

The rapidly increasing number of carriers and squadrons afloat made it necessary to make some significant organisational changes to enable them to operate together. The inspiration came from American practice; the USN’s Carrier Air Groups (CAGs) were formed six months before the carrier commissioned and after between six and nine months at sea would be relieved by a replacement Air Group.¹³²

The main FAA air fighting unit, hitherto the squadron, would be the CAG subdivided into two or more Wings. A CAG would usually consist one TBR Wing and one Fighter Wing each comprising three squadrons which may be from different carriers. On 21 October 1943, Head of Air Branch proposed the formation of the following Wings:

Table 21. Proposed Wing organisation, October 1943 ¹³³

Wing No.	Squadrons	Aircraft Carriers
4 Naval Fighter	807, 808, 879, 886, 809, 897	Hunter, Attacker & Stalker
7 “ Fighter	800, 804, 881, 882, 896, 898	Emperor, Pursuer & Searcher
8 “ TBR	827, 830	Furious
15 “ Fighter	1830, 1831, 1833	Illustrious
21 “ TBR	810, 847	Illustrious
24 “ Fighter	887, 894	Indefatigable
30 “ Fighter	880, 899	Implacable
31 “ TBR	832, 845	Victorious
45 “ TBR	822, 825	Indefatigable
47 “ Fighter	1834, 1835, 1836	Victorious
52 “ TBR	815, 829	Implacable

Each Wing would undergo three weeks of training to obtain a high standard of cohesion between squadrons. Fighter and TBR Wings then worked together for a further two weeks of Group training. The formation of Wings also encouraged the increase in the size of squadrons; Vice Admiral Lyster, FOCT, informed the Admiralty in May 1944 that it was uneconomical for 887 and 894 Squadrons, each comprising twelve Seafires, to form No.24 Fighter Wing. As a result the size of these squadrons was increased to twenty-four machines and operated as such in the Pacific.

¹³¹ Letter from Air Branch to Deputy Director of Stores (Air), 9 Sep 1943, ADM 1/15382.
¹³² Report from CO, HMS Victorious to Secretary of Admiralty, 1 Sep 1943, ADM 1/13385.
¹³³ Message from Head of Air Branch to All ships carrying aircraft and Flag Officers concerned, 21 Oct 1943, ADM 1/13997.

The other revolution was the introduction of the 'operational tour' proposed in April 1944 by Captain Wright, DAWT. Until the spring of 1944 training schedules were sufficient to provide the relief of one crew per squadron per month. Each crew would remain in the front line for between twelve and fifteen months followed by a six to nine month rest period. However Wright's operational tour would apply to the whole squadron rather than just individual crews. Each squadron would carry twenty-five per cent extra crews to cover casualties; in the event that more casualties were suffered the unit would be disbanded.¹³⁴ Captain Grantham, the Director of Plans, supported this concept and hoped that it would lead to more efficient use of resources and would end criticism that the FAA drove its aircrew to their deaths because of overlong tours.¹³⁵

To speed up the formation of new squadrons to enable the operational tour to become reality a new system of aircrew training and squadron working up was proposed in May 1944; the key difference was that aircrew received all operational training with the squadron rather than through specialist training schools. The Commanding Officer, senior pilot and senior observer would train at the School of Air Warfare prior to formation of the squadron and would then be supported by Staff Instructors at the working up station. Three strike squadrons, 812, 814 and 837, and 898 Hellcat fighter squadron were authorised to form under this system and for the strike squadrons there was a considerable improvement: 'It was found to be possible to work up a strike squadron in 5-6 months. Under the old scheme the corresponding period would be 8-9 months. A 30% saving of time was thus achieved.'¹³⁶ An average of 23.7 hours flying per aircraft was achieved compared with 14.2 at flying schools, accidents were reduced from 51 per 10,000 hours to 28.5 and training wastage slashed from 20-25% to only 3-5%. These improvements were attributed to the fact that pilots were keener to learn once they were part of their operational unit, they had the same instructors throughout their training and since they were allocated the same aircraft for training as for operations, they were more interested in maintaining them in good condition. It is interesting how the prospect of more prolonged operations, which eventually were to come to fruition in the Pacific, led to the most wide-ranging changes in the organisation of squadrons during the war.

¹³⁴ Minute by DAWT, 9 Apr 1944, ADM 1/17426.

¹³⁵ Minute by D of P, 1 Jul 1944, ADM 1/17426.

¹³⁶ Reference sheet from DAWT to FONAS, 15 Apr 1945, ADM 1/17426.

Conclusion

Operationally the RNAS had a far more stable existence than the FAA. It could expand its operations at its own pace and did not suffer any serious losses until it deployed a number of squadrons on the Western Front in 1917. The fact that the great majority of its operations were conducted in Britain and France meant that maintaining operations was relatively easy. In contrast the FAA was in the frontline of naval operations from the start of the Second World War, but ironically a lack of carriers, the FAA's *raison d'être* according to the naval expansion programmes, enabled it to play a significant shore-based role. Whereas in the First World War the Admiralty had a surplus of resources and wished to pursue a campaign of strategic bombing but was thwarted, for the first few years of the Second World War the FAA was unable to fulfil all its obligations because of a lack of carriers. When the fruits of these expansion programmes became available in significant quantities during 1943 the navy's operational tasks had also grown and with the worldwide nature of the FAA's operations it was necessary to employ a significant number of CVEs on supply rather than front line duties something that earlier planners had never envisaged. It was not until the Pacific in 1945, as will be discussed in the final chapter that the FAA was able to maximise its operational capabilities.

Chapter 6 – Tactical Logistics and Aircraft Maintenance

Overview

Aircraft are a complex weapon system with a large number of personnel required to maintain them compared with their operation. The ratio of ten non-flying personnel to one aeroplane appears to have been relatively constant throughout this period; No.2 Wing in 1915 had twenty-two aircraft, sixteen pilots and 200 men, while the nominal complement of a squadron of sixteen single-seater fighters in 1945 was five officers, eleven rating pilots and 160 other personnel. Maintenance personnel required extensive training and many of those in the First World War already had considerable engineering experience. Aircraft in 1914-1918 were much more rudimentary and unreliable. Seaplanes were more expensive to maintain and had a shorter service life than aeroplanes, on account of corrosion caused by sea and potential damage while taking off and landing. Airships and flying boats both had large fixed facilities and as such were the most maintenance intensive, while the impact of hotter climates on maintenance regimes was quickly appreciated. For the FAA there was overwhelming dependence on RAF training facilities and the difficulty of keeping pace with large wartime expansion. The worldwide nature of the war caused added difficulties as did the need to maintain aircraft in more intensive and disparate operations than had been envisaged hitherto.

In many accounts of naval aviation, the aircrews get all the plaudits, while the maintenance personnel, the majority of the squadron, are simply forgotten. This is perhaps not surprising since aircrew were in the front line undertaking the operations with all the glamour and danger which they bring. While there are a number of autobiographies of naval aircrew, both pilots and observers, only two published accounts by maintenance personnel have been located during this study.¹ This gap has been filled, firstly, through the resources of the Imperial War Museum especially the Sound Archive and secondly, by an appeal to Second World War veterans in 2004.

First World War

Recruitment and Training

The Navy's expertise in technology proved an undoubted advantage in the pre-war days of the RNAS: 'The maintenance personnel consisted of engine-room artificers and electricians for the maintenance of the airframes, and seaman, stokers and Marines, who

¹ Bill Drake, *A Bit of a "Tiff": Reminiscences of Fifty Years in Naval Aviation* (Bishops Waltham: Platypus Books, 2003) and C. Tapley, *Tango for a Sailor* (Wotton-under-Edge: Masley, 1992).

assisted the artisan ratings, and also handled the aircraft.’² Pre-war training for mechanics was undertaken at Eastchurch: ‘The subjects taken naturally depended upon whether a man was to be trained as an engineer, a Carpenter (Rigger) or general duties, such as clerks, storemen...’³ Training included the principles of flight, internal combustion engines, maintenance of machines and engines, aircraft repairs and handling.

From the records in the Imperial War Museum it is apparent that the majority of fitters and riggers had considerable engineering experience prior to joining the RNAS. An apprenticeship was an essential qualification at the start of the war. A recruitment poster in August 1914 required that applicants had experience in one of the following trades; aircraft repair, carpentry, boat-building, fabric work, fitting or turning, maintenance of petrol engines, coppersmith, electrician, cycle mechanic or driver.⁴ Leading Mechanic Arthur Beeton had completed his marine engineering apprenticeship in 1912 before working at a machine shop on the Hamble River building speedboats and repairing seaplanes at RNAS Calshot.⁵ Rigger Eustace Evans had just completed a five-year apprenticeship in general and automobile engineering when war broke out, while Air Mechanic Conrad Mann served for a similar time at the boat builders Robert Alders in Brightlingsea.⁶ Air Mechanic Henry Stubbington was an apprentice for seven years with Howard Philips, a lighting engineering company.⁷ C.E. Maude of the Air Department noted on 11 August 1914 that a recruitment poster for maintenance personnel was a priority since the RFC had already been issued one. Three days later Maude had to retract his instructions: ‘...this poster should not be too lavishly displayed, and should be subject to immediate withdrawal, as it is understood that the similar poster in the case of the Military brought an overwhelming number of applicants.’⁸ The navy had no shortage of volunteers for maintenance roles.

Recruits demonstrated their skills in trade tests, which were undertaken at Hendon in the early days. Air Mechanic J.H. Connelly undertook a trade test in three parts, practical, oral and interview.⁹ Following the test the instructors graded successful candidates and this appeared somewhat arbitrary as W. Jeffries discovered: ‘...because I did not tip the C.P.O. [Chief Petty Officer] Engineer I was graded as a Leading Mechanic. The person following me could not do the set sum, and was not an experienced Engineer

² Air Chief Marshal Sir Philip Joubert de la Ferté, *The Forgotten Ones: The Story of the Ground Crews* (London: Hutchinson, 1961), 33.

³ RNAS summary, Jan-Aug 1914, AIR 1/674/21/6/21.

⁴ Ibid.

⁵ A.G.Beeton, IWM/SA 8323, Reel 1.

⁶ E.E.H. Evans, IWM/Doc 74/139/1 and C.A. Mann, IWM/SA 28, Reel 1.

⁷ H.R. Stubbington, IWM/SA 298, Reel 1.

⁸ Minute by C.E. Maude for DAD, 11 Aug 1914, ADM 1/8390/255.

⁹ Joubert de la Ferté, *The Forgotten Ones*, 36.

when it came to handling tools, but gave the C.P.O. 10/- and was graded P.O. [Petty Officer].'¹⁰ Arthur Beeton had a similar experience recalling that if he had paid the instructor he could have been a Chief Petty Officer instead of a Leading Mechanic.¹¹ On the other hand Chief Petty Officer Engineer Middleton turned down the possibility of a commission on the basis that it would be a short war:

‘...the Warrant Officer who seemed to be very satisfied passed me through to the Officer who wanted to know if I wanted a Commission and I said “Well how long will that take?” and he said “Oh well, it’ll take three months” and so I said “Oh I’ll think the war will be over before then. I’ll go in, give me what you can” and so I was given Chief Petty Officer Engineer.’¹²

Middleton’s tests included dismantling a radial aeroplane engine. As a former machinist at the Itala Motor Company at Weybridge where he did repair work for Brooklands airfield, Middleton passed with flying colours.¹³

In June 1914 the Air Department laid down its initial training programme. This commenced with six weeks instruction at Sheerness Air School for disciplinary and technical training followed by practical instruction on seaplanes at Eastchurch and Isle of Grain or on airships at one of the airship stations.¹⁴ In practice training initially proved to be rather more rudimentary, perhaps not surprising given the embryonic nature of the RNAS and air power itself. On the day of his arrival at Sheerness, Arthur Beeton was posted to Samson’s squadron at Dunkirk, on the basis that he had used a rifle during four years in the Territorial Army, rather than any engineering skills.¹⁵ W. Jefferies was also ordered to report the transport section of Samson’s Eastchurch Squadron immediately after arriving to Sheerness.¹⁶ By contrast Air Mechanic Conrad Mann, who volunteered for the RNAS in June 1915, had over a month at Sheerness before being posted to Felixstowe Experimental Naval Air Station.¹⁷ Ernest Hancock undertook his basic training at Chatham Barracks in 1916 and this was followed by engine instruction of doubtful value:

¹⁰ Letter from W. Jefferies to Ms B Hudson, IWM/Doc Misc 13 (290).

¹¹ A.G. Beeton, IWM/SA 8323, Reel 1.

¹² J.S. Middleton, IWM/SA 38, Reel 1.

¹³ Ibid.

¹⁴ Report by DAD, 12 Jun 1914, AIR 1/663/17/122/685.

¹⁵ A.G. Beeton, IWM/SA 8323, Reel 1.

¹⁶ Letter from W. Jefferies to Ms B Hudson, IWM/Doc Misc 13 (290).

¹⁷ C.A. Mann, IWM/SA 28, Reel 1.

‘...we went to the old Sunbeam works at Acton, north of London, and there we had what was called training and that was dismantling and re-assembling completely out-of-date aero engines such as the Gnome Le Rhone and Monosoupape rotary engines etc. This was so elementary that it was farcical.’¹⁸

Hancock had spent five years on an apprenticeship with the Vauxhall and West Hydraulic Company in Luton working on steam engines, condensers and boilers. While he had not previously worked on aircraft engines, he clearly regarded his engineering skills as transferable and Vauxhall’s training far superior to the Navy’s. These examples demonstrate the importance of the apprenticeship in the role of the air mechanic as opposed to the naval training, which was largely an introduction to military life. The mechanics in this era were far more skilled than the pilots whose aircraft they repaired. The Instructions for Care and Maintenance of Air Service Materiel issued by the Director of the Air Division on 6 June 1915 included specific advice for the management of mechanics: ‘...for the early part of their training should be out to work with an experienced mechanic. The extreme importance of their work and the fact that bad workmanship may lead to a fatal accident are to be pointed out to them.’¹⁹

By 1916 new entry ratings were first sent on a three week disciplinary course at Sheerness before going on either a six week engineering course or a four week carpentering and erecting course.²⁰ By December 1917 new recruits joined the RNAS at Crystal Palace, were posted to Tregantle for their disciplinary course before attending their training courses at Chingford, Cranwell or Crystal Palace. Ratings training as armourers went to Eastchurch for eight weeks.²¹ From mid-1916 all RNAS officers and men, training on aeroplanes, seaplanes, airships or kite balloons would go to RNAS Cranwell for a finishing course and graduation.²²

Armourer William Hawkins volunteered for the RNAS in December 1916 and after basic training at Crystal Palace attended Eastchurch where he dismantled weapons including revolvers, rifles and Lewis guns and learnt how to fuse and arm bombs. Instruction also took place on the Trombone bombsight and making alterations to the 180lb anti-submarine bomb.²³ By the end of 1917, Eastchurch was providing eight-week courses

¹⁸ E.W. Hancock, IWM/SA 8950, Reel 1.

¹⁹ Instructions for Care and Maintenance of Air Service Materiel from DAD, 6 Jun 1915, ADM 1/2540.

²⁰ General Memorandum No.16 by DAS, 2 Mar 1916, AIR 1/668/17/122/774.

²¹ Report on ‘Training of RNAS Ratings’, 22 Dec 1917, AIR 1/663/17/122/692.

²² Armitage, *The Royal Air Force*, 53.

²³ W.V. Hawkins, IWM/SA 19, Reel 1.

for armourers and gunlayers and three weeks training for W/T (Wireless telegraphy) ratings in addition to instruction for observers plus armament officers and instructors.²⁴

Air Mechanic First Class Henry Stubbington was appointed to the seaplane carrier *Campania* in 1916 and before joining the ship undertook specialised training at the Sunbeam Works in Wolverhampton and the Rolls Royce factory in Derby to learn about the types of engines to be maintained. At the end of 1916 the Admiralty despatched two Large America flying boats to Houton Bay in the Orkneys, but no one in the sixty strong party could maintain their Rolls-Royce engines. As a result Stubbington found competition for his services between Commander Holmes at Houton Bay and Commander Tomkinson of the *Campania*.²⁵

Some mechanics became specialists in their respective fields. Chief Petty Officer Engineer Middleton joined the air station at Farnborough in 1914 and served on airships throughout the war. He was involved in the design of the first Submarine Scout in 1915 and the construction of the first Coastal ship, CP4, which he then accompanied to Longside airship station in Scotland for trials in the summer of 1916. He joined the first rigid airship R9 at Barrow for two months and was then posted to a party to test rigid airships for the remainder of the war.²⁶

The initial flood of volunteers began to dry up in 1915, but the prospect of conscription in January 1916 changed all this according to Lieutenant Le Bailly in charge of RNAS recruiting between February 1915 - August 1916:

‘...by early 1916, a crowd of 2,300 assembled every morning, and we had to close the doors at 9.30 a.m. Soon we... reached 150 recruits per day, kitted up and dispatched to Crystal Palace. Undoubtedly the intelligent youth of the nation realised that the life of an aircraftsman was heaven compared with the hell of the trenches.’²⁷

In December 1917, the Admiralty Committee considering personnel requirements for the New Aircraft Programme found there was a shortage of recruits:

‘For several weeks there has been a considerable shortage of Ratings (especially Mechanics) entered for the R.N.A.S. and there is at present a deficiency of 1348

²⁴ Summary of notes on training of RNAS personnel, 1914-1918 by Mr J.C. Nerney, Sep 1917, AIR 1/678/21/13/2082.

²⁵ H.R. Stubbington, IWM/SA 298, Reels 5-6.

²⁶ J.S. Middleton, IWM/SA 38, Reels 1-4.

²⁷ R.F. Le Bailly, *Reminiscences of service in WWI*, 6, Fleet Air Arm Museum 2001/138/0002.

on full requirements which are now estimated at 750 a week. The entry of 750 a week would gradually reduce the shortage and by the 30th June 1918, the full strength required by the Aircraft Programme should be attained.’²⁸

To address a lack of Air Gunners, Wireless Operators and Aircraftsmen, the Second Sea Lord hoped to transfer some naval ratings to fill these gaps. From 1 January - 30 June 1918, 12000 ratings were to undergo training followed by a further 3850 from 1 July - 31 December. This training programme would raise the ratings strength of the RNAS from 32058 on 1 September 1917 to an estimated 48500 on 31 December 1918.²⁹ The RFC had a much greater problem recruiting enough mechanics due to the larger size of the service; the army was combed for suitable mechanics, but it was realised that it would need to train its own maintenance personnel. At first a variety of locations were used, but in June 1917 Halton Park was chosen as the location for the RFC’s No.1 School of Technical Training. At the beginning of 1918 Halton had 1700 staff training 6000 men, 2000 boy mechanics and 2000 women.³⁰ An interesting set of figures are available for the number of officers and men employed by the RNAS on ground duties in 1916 - 1917:

Table 22. Officers and men on ground duties, April 1916 – August 1917 ³¹

	Aeroplanes & Seaplanes	Airships	Kite Balloons	Depots & Workshops
1-30 Apr 1916	260 Officers + 7600 Men	120 + 2300	30 + 1300	n/a
1-14 Jul 1916	369 + 6000	149 + 2300	25 + 1300	n/a
15-28 Feb 1917	459 + 9654	165 + 3912	33 + 1052	9319
16-30 Jun 1917	579 + 12266	180 + 4091	36 + 1077	10123
16-31 Aug 1917	671 + 17298	184 + 4824	37 + 1796	12191

The vast majority of maintenance personnel, 62 - 72%, were employed working on aeroplanes and seaplanes with 20 - 26% on airships and the remainder working with kite balloons. From the available figures between February - August 1917 it can be seen that more than one-third of the overall total were in depots and workshops. In addition to maintaining engines or airframes, roles ranged from armourers and wireless mechanics, to

²⁸ Report by Admiralty Committee on ‘Personnel for New Aircraft Programme’, Dec 1917, Doc 214 in Roskill, *Documents Relating*, 601-602.

²⁹ Summary of notes on training of RNAS personnel, 1914-1918 by Mr J.C. Nerney, Sep 1917, AIR 678/21/13/2082.

³⁰ Armitage, *The Royal Air Force*, 20.

winch operators for kite balloons. Armourers had an important role since they were responsible for fitting guns and bomb racks on early aircraft. Some mechanics were airborne as gunlayers in bombers and engineers in airships and flying boats.

Operations in Britain

Pre-war it was common practice to return aircraft to the manufacturers for repair since the cost of new aircraft appeared as a separate entry on Naval Estimates compared with that allocated for aircraft repair: 'When an old aircraft was returned for repair, the contractor was enabled to design an entirely new aircraft, though he was supposed to incorporate something of the old one.'³² Engine unreliability was an inherent problem in the early years of aviation and C. Draper, appointed Commanding Officer of Gosforth aerodrome in December 1914 had a number of forced landings: '...I made no fewer than six myself in three months... Let it be said at once that none of these had anything to do with care and maintenance, and there was no reflection on the mechanics.'³³ The inaccessibility of airship engines was highlighted by a trip of airship No.4 from Farnborough in April 1914:

'...the starboard engine cut out, but was going again within five minutes. Shortly afterwards a tappet guide of the starboard engine was carried away and was replaced in 40 minutes, which I consider a very creditable bit of work as it was necessary to lie on the engine and... put his head through the side rails...'³⁴

From mid-1915 air stations were instructed that aircraft written off should be dismantled and any re-usable parts should be retained for further use: 'All serviceable parts such as eyebolts, strut fittings, engine bearers, &c should be sent to the RNAS Store at Wormwood Scrubs.'³⁵ The policy of dismantling aircraft for spares was pursued unofficially by squadrons in the Second World War, before its official adoption under the title of 'reduce to produce'.

A series of visits to air stations by the Director of Air Services between April - August 1917 revealed a wide range of maintenance standards. RNAS Newlyn in Cornwall appeared to operate an inflexible policy:

³¹ First Lord's RNAS fortnightly returns, Apr 1916 - Aug 1917, AIR 1/150/15/113/1-3.

³² Bell-Davies, *Sailor in the Air*, 75.

³³ Draper, *The Mad Major*, 48.

³⁴ Report by CO, HMA No.4, 21 Apr 1914, AIR 1/659/17/122/612.

‘There appears [to be] a great tendency at this station not to endeavour to obtain the maximum possible service from the machines and engines they have. The general idea seems to be simply [to] demand on the White City [depot] for a new part and keep the machines out of service indefinitely until the part is forthcoming, instead of trying to repair or make other parts...’³⁶

In contrast the maintenance at Dover was praised for its quality both in rebuilding machines and overhauling engines despite less than ideal conditions. The Handley Page Squadron at Manstone was commended for keeping its aircraft operational given the state of the airfield:

‘During the last week the whole place has been under water. I was much struck by the extraordinarily good condition these machines were in after many months of service, having been out in all kinds of weather. They are being completely overhauled and fitted with unarmoured power units...’³⁷

Maintenance at some stations was hampered by a shortage of aircraft and spares. Six new Short seaplanes powered by 240hp Renault Mercedes engines supplied to Calshot were all out of action due to repeated engine defects, most of which required complete removal of the engine. Training at RNAS Cranwell was suffering because of the lack of spares for 80hp Gnome engines and four repaired engines were being supplied to alleviate the shortage. Cranwell also required an overall increase in its repair capacity:

‘...the workshops’ output is approximately 35 – 40 machines a month... On the other hand the smashes per month are between 60 and 70, and will, in all probability, increase... it may be necessary to increase the workshops staff by about 70 – 80 hands, and allocate another 200’ x 100’ shed for the repair of machines.’³⁸

In May 1917 Commodore Samson conducted an investigation for the Air Department as to the efficient use of manpower at naval air stations:

³⁵ Instructions for the Care and Maintenance of Air Service Materiel from DAD, 6 Jun 1915, ADM 1/2540.

³⁶ Report of visit by DAS to RNAS Newlyn, 29 Apr 1917, AIR 1/150/15/108.

³⁷ Report of visit by DAS to Handley Page Squadron, Manstone, 8 Aug 1917, AIR 1/150/15/108.

³⁸ Report of visit by DAS to RNAS Training Establishment Cranwell, 7-8 May 1917, AIR 1/150/15/108.

‘...I am afraid that I was not too enthusiastically received at one or two soft billets, like Wormwood Scrubs and the White City, where quite a number of men were stationed doing practically nothing. I can claim to have saved a good many men, and built up the strength of our fighting units, by having had a number of men removed from quiet peaceful jobs to active units overseas and on the coast.’³⁹

The intensity of flying boat patrols at Killingholme in 1917 resulted in a shortage of volunteer engineers for afternoon flights once novelty of the two shillings extra flying pay had worn off and the men appreciated the serious impact on their evening’s leave. The Commanding Officer was unable to increase pay, but instead offered extra leave, which quickly solved the problem.⁴⁰

Operations in France

The first deployment to the continent by Samson’s Eastchurch Squadron was a somewhat ad hoc affair:

‘Mr Brownridge, a carpenter, RN, was my repair officer, and what he didn’t know about the repair and upkeep of aeroplanes wasn’t worth knowing... In addition to the aeroplane men, who were about seventy in number, I had twenty specially enlisted transport drivers... the majority being very highly skilled motor mechanics and testers from the Rolls-Royce, Wolseley and Talbot motor-car firms.’⁴¹

In the early days aircraft were not equipped with bomb racks and Brownridge made a bomb carrier for Samson’s aircraft carrying eighteen 16lb bombs which could be drop singly, in threes or altogether. C. Draper, a pilot in No.3 Wing based at Ochey in northern France in 1916, recalled that an aircraft returned with a bomb caught in the flaps and as two mechanics were helping to guide it back into the hangar it was dislodged and exploded killing Leading Mechanics A. Simms and Jock Fraser.⁴²

A detailed picture is available of Dunkirk’s maintenance requirements. In January 1916 approval was given for the force at Dunkirk to be expanded to three Wings. Each Wing comprised twenty-four pilots, eight observers and seventy ratings complemented by a

³⁹ Air Commodore Charles R. Samson, *Fights and Flights* (London: Ernest Benn, 1930), 355.

⁴⁰ H.R. Stubbington, IWM/SA 298, Reel 9.

⁴¹ Samson, *Fights and Flights*, 4.

⁴² Draper, *The Mad Major*, 59.

Headquarters workshop at Dunkirk was manned by two officers and forty-three men. The Reserve Squadron at Dover was manned by six pilots, two observers and seventeen ratings. These were supported by one officer and nineteen men in the workshop and two officers and thirteen men in the Central Store Depot at Dover. To assist in the operation of seven seaplanes from Dunkirk were seventy-one ratings and eighty ratings for the eight machines at Dover.⁴³ By January 1917 each of the three flights of No.1 Seaplane Squadron at Dover was manned by four officers, two Petty Officers and twenty-eight ratings while the four flights of No.2 Seaplane Squadron at Dover each had four officers and thirteen ratings.⁴⁴ For the reorganisation at the Dunkirk and Dover in December 1917 the following maintenance personnel were required:

Table 23. Maintenance requirements at Dunkirk and Dover, Dec 1917 ⁴⁵

	CPO	PO	Ratings	Total
Fighter Squadron	3	12	117	132
Bombing Squadron (D.H.4s)	2	17	186	205
Reconnaissance Squadron	2	16	179	197
Dover Seaplanes	8	14	181	203
Dunkirk Seaplanes	5	15	148	168

A report on Dunkirk’s Large America seaplane No.8695 in October 1917 concluded that out of ninety-six days on station, it was unfit for service on forty-eight days while on thirty-two days when it was available the weather was unsuitable for flying. The principle reason for unserviceability was hull damage, with engine trouble a secondary factor.⁴⁶ Repairs at this station were hampered by the lack of a heavy crane or overhead run-way which were necessary to gain access to hull of a Large America, nor were such facilities available at Dover.⁴⁷ In 1918 it was estimated that flying boats, which remained largely in the water, would have a service life of only 6 months.

For the aeroplane squadrons at Dunkirk it was decided in December 1916 that a Central Repair Depot should be established at St Pol with: ‘...the two outlying Wings so

⁴³ Letter from DAS to Vice Admiral, Dover Patrol, 19 Jan 1916, AIR 1/665/17/122/709.
⁴⁴ Letter from CO, HM Seaplane Station, Dover to SO, RNAS Dover, 27 Jan 1917, AIR 1/641/17/122/216.
⁴⁵ Letter from SO, RNAS Dover to DAS, 17 Dec 1917, AIR 1/663/17/122/693.
⁴⁶ Letter from SO, RNAS Dunkerque to Vice Admiral, Dover Patrol, 15 Oct 1917, AIR 1/642/17/122/238.
⁴⁷ Report from CO, RNAS Dunkirk to Vice Admiral, Dover Patrol, 3 Dec 1917, Doc 212, in Roskill, *Documents Relating*, 597.

constituted that they are enabled to carry out minor repairs only...'⁴⁸ This depot, a forerunner of the Aircraft Repair Yards in the Second World War, would undertake all major repairs and was stocked with large quantities of stores, spare parts and engines. Unfortunately this presented a tempting target for German bombers, which delivered a series of devastating raids in the autumn of 1917. Philip Bartlett, a No.5 Squadron pilot, recalled the damage caused on 24 September: '...a large bomb wrecked the engine and repair shops. Both were entirely gutted and some 200 rotaries (Clergets, Le Rhones and ARs) destroyed, as well as all the lathes and other machinery. Certainly a warm day in more senses than one.'⁴⁹ A further devastating raid took place on 1 October:

'The damage at the Depot is colossal – one large and one small hangar utterly destroyed and all the other hangars perforated and their sides blown out. The small arms store wrecked and an enormous crater filling the site of the former bomb store... 200 bombs were dropped... and, in all, 200 engines and 150 aircraft destroyed, including some at St Pol aerodrome. The Depot is being disbanded.'⁵⁰

The result was that '...the Aircraft Depot was at once decentralised into various sub-depots and parks.'⁵¹ Such attacks brought maintenance personnel into the front line, a raid on Ochey airfield on 15 November 1917 resulted in one air mechanic of No.6 Squadron being killed and several wounded.⁵² For the regular supply of engines to France a service was started between Cardiff and Nantes in January same month of three colliers per month each with a capacity for 100 – 200 tons of material.⁵³ The following month, Lambe, the Senior Officer at Dover complained of a chronic shortage of spares: 'I think that the Air Department... has totally forgotten the supply of spare engines for our new machines. Lately we have had no spare engines supplied at all, and we have always lived from hand to mouth...'⁵⁴ Old Nieuport machines had to be stripped of their 110hp Clerget and 80hp Le Rhone engines to provide spares.

The intensive operations by former naval squadrons during the critical spring and summer of 1918 saw a considerable demand placed on maintenance personnel. In May and

⁴⁸ Letter from SO, RNAS Dover to Vice Admiral, Dover Patrol, 8 Dec 1915, AIR 1/629/17/120/13.

⁴⁹ Squadron Leader C.P.O. Bartlett, *In the Teeth of the Wind: The Story of a Naval Pilot on the Western Front, 1916-1918*. Edited by Nick Bartlett (Annapolis: Naval Institute Press, 1994), 135.

⁵⁰ Ibid, 87.

⁵¹ History of 207 Squadron RAF (late No.7 Squadron RNAS), 12, AIR 1/695/21/20/207.

⁵² History of 216 Squadron RAF (late No.16 Squadron RNAS), 3-4, AIR 1/695/21/20/216.

⁵³ Procedure for organisation of engine material in France, 1 Mar 1917, AIR 1/151/15/114.

⁵⁴ Letter from SO, RNAS Dover to Naval Assistant to Fifth Sea Lord, Feb 1917, AIR 1/151/15/114.

June 1918, No.206 Squadron carried out up to five operations per day often starting at 3am and not finishing until 9pm and the squadron history recorded an appreciation of the maintenance effort:

‘The mechanics were working all night, night after night, and anyone walking around the hangars, would see them sleeping, dead beat, for an hour, whilst one of the Squadron Raids was away. On many occasions, when fine weather was continuous, this was the only sleep they got. Their spirit, pride in their Squadron, and unflagging energy and cheerfulness was magnificent...’⁵⁵

For example Pilot Philip Bartlett of No.5 Squadron flew on four raids on 23 March 1918 taking off at 08.51, 11.25, 14.26 and 16.59 with thirty minutes rest between sorties when mechanics had to refuel and rearm the aircraft.⁵⁶

Overseas operations

In logistic terms the RNAS’s deployment to the Dardenelles was a ground breaking one for aviation – the first long-term, relatively large scale operation conducted in an overseas theatre. In addition the early types of aeroplanes and seaplanes were exposed to the hotter Mediterranean climate which caused further difficulties. The first ten aeroplanes were delivered in crates onboard a merchant ship and Squadron Commander Samson recalled their arrival at Tenedos on 26 March 1915:

‘We had to unload them from the *Abda*, transport them in ships’ boats, then disembark them on to an open beach, and finally haul them up to the aerodrome, about a quarter of a mile distant. When it was realised that the Maurice Farman aeroplanes were stowed in packing cases 47 feet long, it can be readily understood that we were faced with quite a considerable task.’⁵⁷

To land the cases a battleship’s launch and sailing pinnace were lashed together and a platform built over them onto which the crates were placed. Once ashore a hundred sailors and sixty Greeks hauled the crates up the road to the airfield in a two-day operation. Some packing cases were turned into workshops and stores rooms. However, in November 1915 a fire destroyed the main workshop and some stores resulting in a chronic spare shortage and

⁵⁵ History of 206 Squadron R.A.F. (late No.6 Squadron RNAS), 3, AIR 1/695/21/20/206.

⁵⁶ Bartlett, *In the Teeth of the Wind*, 135.

⁵⁷ Samson, *Fights and Flights*, 220.

Samsom was called before a Court of Inquiry: ‘...I found it difficult to convey to the Court that a battleship was an entirely different thing from a collection of buildings roughly constructed out of aeroplane packing-cases... The censure was, I felt, unfair...’⁵⁸

When the operation began on 25 April Samson established a landing ground at Cape Helles on the tip of the peninsula from which two aircraft operated in daytime, but the losses proved prohibitive: ‘It was a hectic spot, as of course it was within full view of the Turks, and well within field-gun range... I lost five aeroplanes there, hit by shells, and at last it got too expensive, and we gave up the use of it.’⁵⁹

The history of No.3 Squadron recorded the influence of the tough environment: ‘Throughout the operations in the Peninsula, the unit experienced all the trials and difficulties attendant upon aerial work in a semi-tropical climate.’⁶⁰ The Commanding Officer of Ark Royal also praised the efforts of the RNAS: ‘Many of the units had only recently been formed and had no experience of service away from good sheds and other conveniences. The heat, flies and dust rendered the work of Officers and men on shore very laborious...’⁶¹ Lieutenant Bell-Davies found his 80hp Gnome powered Henri Farman aircraft to be hopeless in the conditions: ‘They were badly underpowered and very lightly constructed. Under the strong sun they warped; the fabric slackened and soon rotted.’⁶² Voison pusher biplanes powered by Canton-Unné engines which arrived in May were a great improvement due to their steel construction, but like most aircraft in that climate had to be run at full power when climbing to operational height.

The seaplane depot ship HMS *Ark Royal* arrived at Tenedos on 17 February. She was a revolutionary ship which supported the RNAS’s deployment in the Mediterranean throughout the war and presaged the role of HMS *Unicorn* and other air maintenance ships during World War Two. Such was her utility that it was suggested later in the war that a second similar vessel should be obtained in case *Ark Royal* was lost. Up to 31 May 1915 eleven seaplanes were operated from the ship and the maintenance of these was problematic due to five different types of seaplanes and three types of engines: ‘The innumerable difficulties encountered... owing to the numerous types of machines and engines, point strongly to the desirability of... a homogeneous type. A considerable difficulty is reported in obtaining spare parts and other stores from England.’⁶³ Over the whole year flights were made on 178 days, an average of 2.46 hours per flying day. In the

⁵⁸ Ibid, 277-278.

⁵⁹ Ibid, 238-239.

⁶⁰ History of 203 Squadron RAF (late No.3 Squadron RNAS), 1911-1923, 2, AIR 1/695/21/20/203.

⁶¹ Report from CO, HMS Ark Royal to Rear Admiral & SNO, Salonika, 5 Feb 1916, AIR 1/649/17/122 +18.

⁶² Bell-Davies, *Sailor in the Air*, 121.

first three months the shortage of spares from England resulted in seaplanes Short No.136 and Wight No.172 being rendered unserviceable on 3 March and 4 April respectively. Wight No.173 and Sopwith No.807 had unsatisfactory performance and were dismantled to provide spares for other aircraft. Seaplanes No.922, 1437 and 1438 were embarked for spotting on the cruisers HMS *Doris* and HMS *Minerva* but they were not stored in ideal conditions: 'The exposure combined with the effects of firing the ships' 6" inch guns has a very detrimental effect on the machines and, when they return from these ships they always require a thorough overhaul.'⁶⁴ The Short seaplanes were old, the Wights often failed to take off and could not gain sufficient height, while the Sopwiths had such a slow rate of climb that much of their time in the air was wasted on gaining the required height. Engine reliability improved during the year with the arrival of more modern types:

'One in every 3.88 flights was brought to a premature conclusion through engine trouble, which supervenes on the average 3.43 hours flying. These averages however, have improved in the last six months flying since the ship has been supplied with modern Short seaplanes which do not necessitate the engine being continually run at full power.'⁶⁵

Many of the same problems attended Samson's aeroplanes. The initial deployment comprised five officers and twenty-seven men with touring cars, two light tenders and two lorries, the latter containing Samson's aeroplane No.50, petrol, oil, bombs, tools and spares.⁶⁶ The number of maintenance personnel did not keep pace with the increase in aircraft as Colonel Sykes, RFC, recommended in his report in July 1915:

'...Commander Samson has to retain the transport drivers of the Squadron for work with the aeroplane stores etc., and has not returned them to Alexandria... If 80 to 100 well trained men could be added to the number in the field the whole could be organized into definite sub-units, and a more equal distribution of the work would lead to increased efficiency.'⁶⁷

On average Samson had only seven pilots, against Sykes' estimate that three squadrons were needed. The arrival of two pilots in August 1915 increased this to a peak of eleven.

⁶³ Report from Colonel Sykes to Secretary of Admiralty, 9 Jul 1915, 1, AIR 1/625/17/12.

⁶⁴ General remarks by Commander, HMS Ark Royal, 1 Jun 1915, AIR 1/361/15/228/49.

⁶⁵ Report from CO, HMS Ark Royal to Rear Admiral & SNO, Salonika, 5 Feb 1916, AIR 1/649/17/122-418.

⁶⁶ Samson, *Fights and Flights*, 215.

⁶⁷ Report from Colonel Sykes to Secretary of Admiralty, 9 Jul 1915, AIR 1/625/17/12.

Sykes also recommended the acquisition of a repair and store ship to support SS airships in the Dardanelles equipped with a gas generating plant, workshops, an engine testing house and instrument repair ship. With the ship in attendance, a minimum of personnel, stores and equipment would be deployed ashore.⁶⁸ In the spring of 1916 a Central Repair Depot was proposed for Mudros and thirty-five ratings were to be sent out from England: ‘... [it] should enable a great economy to be effected in the demand for machines from England, as many repairs can then be undertaken which, due to lack of staff and time, are at present impossible...’⁶⁹ The need for adequate maintenance in the demanding climate of the Mediterranean was reinforced when Samson’s seaplane returned to the *Ben-My-Chree* on 13 September 1916 and experienced a somewhat unusual problem:

‘...after alighting and whilst taxi-ing to the ship the engine fell out of the bearers and the propeller flew off into space. Subsequent examination showed that the front spars of the fuselage were rotten with age and usage. Of course, like the majority of our seaplanes, it had seen hard service from some time in hot climates.’⁷⁰

Deployments in Mesopotamia and in the tropics of East Africa produced similarly demanding conditions; in the latter experience wood warped and glue melted causing seaplanes to almost fall apart. Modern aircraft also require a much enhanced maintenance in such demanding conditions.

Inter-war years

The impact of dual control on the FAA is usually emphasised in the terms of an inefficient aircraft production system and a lack of senior air minded naval officers. The fact that aircraft maintenance was run entirely by the RAF is often overlooked. This was important because of the difficulty of building up a naval air maintenance organisation largely from scratch, with few experienced air engineer officers and a lack of training facilities. When the government announced the transfer of the FAA to the RN in July 1937, the maintenance situation was thus:

⁶⁸ Ibid.

⁶⁹ Letter from Wing Captain, RNAS Headquarters, Mudros to VAC, British Mediterranean Squadron, 8 Apr 1916, AIR 1/649/17/122/422.

⁷⁰ Samson, *Fights and Flights*, 334.

‘There were no naval maintenance ratings of any kind, and it was anticipated that for the then authorised rate of expansion of the Fleet Air Arm to 450 aircraft (in carriers and catapults) by 1942, approximately 8,000 of these ratings would be required. Something like a half of that number was needed immediately, since the number of aircraft in 1938 was slightly over 200...’⁷¹

Leading Aircraftsman Perry Carter, on a two-year secondment to the navy, was aboard HMS *Courageous* with 821 Squadron in 1938 when the request was made for volunteers: ‘...ground staff under the rank of Sergeant to volunteer to change from the Royal Air Force to the Royal Navy. For this consideration each Airman on changeover would be promoted to Petty Officer.’⁷² But volunteers themselves were never going to be enough and it would be necessary to compel some RAF personnel to join the FAA. The problem was that the Air Ministry did not have the power to do so, except for a temporary attachment, which would not be adequate in this case. Sir Thomas Inskip, Minister for Co-ordination of Defence proposed the following solution to the First Lord, Duff Cooper, in April 1938:

‘...units of the Fleet Air Arm should be organised in two components, (a) a purely naval component consisting wholly of naval pilots, observers and ratings including any present Air Force personnel who transfer voluntarily from the Air Force to the Navy; and (b) an Air Force component consisting of R.A.F. officers and men who are unwilling to transfer to the Navy.’⁷³

Kingsley Wood, the Air Minister, wrote to Cooper on 28 July to confirm the period of the loan: ‘...the time limit should not exceed five years as I quite see that our original proposals for three years, if rigidly adhered to, might be embarrassing to you if the response of Royal Air Force personnel on the transfer question was small...’⁷⁴ To meet the FAA’s requirements 150 RAF officers and 1,500 ratings, which later rose to over 2,000, were transferred to the navy.⁷⁵

To replace the RAF men with naval personnel in the medium term, the training of naval maintenance ratings began immediately under the auspices of the RAF, but there was concern at the lack of expertise of naval personnel: ‘Lower standards had to be accepted, both in the length of training where artificers are concerned and in the proportion of skilled

⁷¹ Naval Staff History, *The Development of British Naval Aviation 1919-1945: Volume 1*, 11, ADM 234/383.

⁷² P.S.J. Carter, *Under four Monarchs: Come and be one of us. The Autobiography of an Erk*, 98-99. IWM Doc 90/11/1.

⁷³ Letter from Minister for Co-ordination to First Lord, 26 Apr 1938, ADM 1/9714.

⁷⁴ Letter from Air Minister to First Lord, 28 Jul 1938, ADM 1/9714.

to unskilled men. Commands and the administrative posts had to be filled by officers who, in many instances, had no previous technical or specialised experience.’⁷⁶ Rear Admiral Bell-Davies VC, appointed Rear-Admiral Naval Air Stations in the autumn of 1938, also noted the requirement for civilian mechanics: ‘The biggest problem was the provision of technical ratings. The Air Ministry had agreed to lend a certain number of air mechanics, but until naval ratings could be recruited and trained we should have to rely largely on civilian mechanics for workshop staff.’⁷⁷

The Second World War

Recruitment and Training

In *Hostilities Only* Brian Lavery has detailed the changes to the training for Air Artificers, Air Fitters and Air Mechanics during World War Two.⁷⁸ The Navy supervised the training of a number of important maintenance personnel, for example courses for Air Engineer Officer candidates at Loughborough College, a postgraduate course for Air Engineer RNVR officers at RNAS St Merryn and all training for Air Artificers was undertaken at ATE Torpoint, Rosyth and RNATE Newcastle. However, Wren Air Mechanics were the only ratings whose training was wholly undertaken by the navy, while Air Fitters had their basic training at RNTE Watford and Fulham.⁷⁹ For detailed accounts of the training of artificers at Newcastle-under-Lyme and Wren Air Mechanics at HMS *Fledging* see *Ship Without Water* and *The Fledglings* respectively, both by Graham Bebbington.⁸⁰

But the majority of training for Air Fitters and Air Mechanics between 1938-1943 was carried out by the RAF at Hednesford, Henlow, Kirkham, Locking and Melksham as the following table shows:

⁷⁵ Article by DAMR in ‘Maintenance Matters’, 1945, ADM 1/17430.

⁷⁶ Naval Staff History, *The Development of British Naval Aviation 1919-1945: Volume 1*, 11, ADM 234/383.

⁷⁷ Bell-Davies, *Sailor in the Air*, p.231.

⁷⁸ Brian Lavery, *Hostilities Only: Training the Wartime Royal Navy* (London: National Maritime Museum, 2004), 115-117.

⁷⁹ Report from Rear Admiral (E) D.C. Ford to Vice-Admiral Sir F. Turner, Engineer-in-Chief, 21 Dec 1943, ADM 1/17685.

⁸⁰ Graham Bebbington, *Ship Without Water: The Story of HMS Daedalus II* (Leek: Churnet Valley Books, 1999) and Graham Bebbington, *The Fledglings: The Story of HMS Fledgling* (Leek: Churnet Valley Books, 2003)

Table 24. FAA ratings trained by the RAF, 1938-1943 ⁸¹

Type of Instruction	Total No. entered	Total No. qualified	Total No failed /discharged for other reasons	Total No. still in training
P.O. Air Fitters & Leading Air Fitters Conversion (E) and (A)	(E) 361	259	40	62
	(A) 378	301	29	48
Air Fitters	(E) 3457	2255	487	715
	(A) 3423	2336	352	735
Air Mechanics	(E) 3244	1503	320	1421
	(A) 3291	1572	279	1440
Air Mechanics ex RAF Locking	(E) 2908	2427	473	-
	(A) 2938	2414	502	-
Air Fitters (O)	310	37	-	273
Air Mechanics (O)	3237	2153	101	983
Air Fitters (L)	361	Nil	Nil	361
Air Mechanics (L)	1891	143	16	1732
Air Mechanics (L) ex RAF Melksham	1914	1834	80	-
Total	27713	17234	2679	7770

Unsurprisingly the Navy was anxious that it should be training its personnel in its own establishments. In September 1942 Captain Huskisson, DAMR, estimated that an establishment to handle the training of all Air Maintenance ratings, except Air Artificers, Radio Mechanics and Wrens, would require for accommodation for 5,000 and there was not time to undertake such an ambitious project.⁸² Even if the Air Ministry were willing to release establishments for naval use, which it was not, it would be impossible to man them. The Head of Air Branch came to a similar conclusion during review in January 1943 citing the lack of instructors and administrative personnel even if the facilities were transferred.⁸³ In June 1944 the Flag Officer Naval Air Stations believed that the training of maintenance ratings wholly by the navy was desirable for a number of reasons:

⁸¹ Report from Rear Admiral (E) D.C. Ford to Vice-Admiral Sir F. Turner, Engineer-in-Chief, 21 Dec 1943, ADM 1/17685.

⁸² Minute by DAMR, 24 Sep 1942, ADM 1/17468.

⁸³ Letter from Head of Air Branch to RANAS, 13 Jan 1943, ADM 1/17468.

‘...due in part to the fact that difficulty was found in getting the Royal Air Force to agree to modification of syllabus to suit Naval requirements, but still more to the perfectly natural and understandable effect on the morale, enthusiasm and interest of the Naval ratings through their being housed, trained, drilled and punished by another Service.’⁸⁴

While the navy may have been concerned about the effect on naval ethos that training by the RAF might have, no serious complaints were raised by senior naval officers about the standard of RAF technical training which was generally regarded to be of a high standard. In the event it was not possible to train all FAA maintenance personnel in naval establishments until after the end of the war.

Given the shortage of naval maintenance personnel there were a valuable commodity as Air Mechanic R.H. Law discovered when he completed his training in 1940 and reported to RNAS Lee-on-Solent:

‘...an Admiralty Fleet Order came out saying that volunteers were required for flying duties so I requested to change category and went off in front of the commander and he said “Good lord, do you think we’ve spent all this money on teaching you to be an air mechanic and then you go on to fly? You’ll probably crash the first time you go up and we’ve lost all that money. So, no not granted.”’⁸⁵

Many recruits had engineering backgrounds and were made to take trade tests in a similar manner to their First World War counterparts, although the subsequent allocation of rank was rather fairer. Joe Ainley, who worked for Armstrong Siddeley Motors as an apprentice, took a trade test at HMS *Sultan* and admitted: ‘I just scraped through’. He joined No.6 School of Technical Training at RAF Hednesford where he trained as an Air Fitter (Engines), the three year peacetime course compressed into nine months.⁸⁶ John Holland completed a four-year engineering apprenticeship at BP and ICI before joining the FAA in 1940 and ended the war as a Petty Officer Air Fitter (Engines),⁸⁷ while Roy Maber had

⁸⁴ Letter from FONAS to Secretary of Admiralty, 5 Jun 1944, ADM 1/17468.

⁸⁵ R.H. Law, IWM/SA 18701, Reel 1.

⁸⁶ *Ruler's Reign: The Story of a Lend Lease Escort Carrier and Her Squadron, 1943-1946* by Some of Her Ship's Company and 885 Squadron Personnel, Chapter 9, p.3, unpublished.

⁸⁷ Letter from John Holland to the author, 23 Sep 2004.

served a two-year apprenticeship at Shelly's Boatyard, Gosport, building luxury cabin cruisers, before joining the FAA as a Air Mechanic (Airframes).⁸⁸

Wartime Expansion

The size of the maintenance organisation increased rapidly as Captain Ford, DAMR, reported in February 1940: 'The number of Officers and Ratings now forming the maintenance branch (including those under training) now total some 120 Officers and 5000 ratings.'⁸⁹ By October, it had expanded still further and: '...now consists of a body of about 150 Officers and 7000 ratings in addition to some 700 civilian workmen, and is increasing rapidly... The department is responsible for... the facilities for repair of some 1200 Aircraft.'⁹⁰

In numerous operations the continued support of the RAF was indispensable. Air Mechanic (Airframes) Roy Maber recalled his time aboard HMS *Eagle* in 1940: 'RAF maintenance staff were very essential in the early days when us air mechanics were inexperienced... The better trained air artificers did not appear on the scene until later in the war.'⁹¹ When Air Fitter (Airframes) Cyril Tapley joined RNAS Hatston in the spring of 1940 he found that: 'Air Force personnel were still very much in evidence... The senior non-commissioned officer in charge of the workshops was in fact a Flight Sergeant.'⁹² and while Pilot Donald Judd was with 826 Squadron at Dekheila, Egypt, in 1941: 'The squadron ground crew were mostly naval ratings, who were made up the fitters, riggers, armourers, etc., but the head of each 'trade' was an RAF sergeant... charge of the ground crews was Flight Sergeant Stinchcombe. He ruled the... maintenance side, with an organising ability and professionalism which inspired his ratings...'⁹³

In December 1942, in accordance with the air expansion programmes, the Director of Personal Services forecast a large increase of 10,500 Air Fitters and Air Mechanics in the next fifteen months which would need the recruitment of 13,700 to take account of wastage.⁹⁴ To meet this target the monthly output would have to be increased from 750 to 1670.⁹⁵ Captain Bedale, DAMR, stressed the importance of the role experienced maintenance ratings would have to play:

⁸⁸ Letter from Roy Maber to the author, 14 Aug 2004.

⁸⁹ Minute by DAMR, 28 Feb 1940, ADM 1/16543.

⁹⁰ Minute by DAMR, 10 Oct 1940, ADM 1/16543.

⁹¹ Letter from Roy Maber to the author, 28 Aug 2004.

⁹² Tapley, *Tango for a Sailor*, 81.

⁹³ Donald Judd, *Avenger from the Sky* (London: William Kimber, 1985), 43.

⁹⁴ Letter from DPS to Deputy CNAS, 12 Dec 1942, ADM 1/17468.

‘...a projected increase of over 100% within 12 months in the total F.A.A. maintenance strength without any comparable increase in the number of experienced and supervisory ratings, will, if achieved, carry dilution beyond the point where reasonable efficiency and safety can be looked for in the upkeep of Fleet Air Arm aircraft.’⁹⁶

The importance of the continued support of RAF should not be under-rated; in mid-1943 of the 19,238 trained FAA maintenance personnel, 2,274 or 11.8 per cent were on loan from the RAF.⁹⁷ By the autumn of 1943 it was necessary to reduce requirements to taken into account an overall shortage of 1800 ratings. This including cutting the increase in first line aircraft for the year from 200 to 180, manning of new training squadrons at eighty per cent and the formation of only one mobile airfield and no salvage sections in 1943.⁹⁸ The strain on the training system was unsurprising given the large number of aircraft carriers which had entered service and that the number of shore establishments had increased from thirty to seventy since 1941.⁹⁹

At the end of 1943 the Director of Personal Services reported that for the first time output was meeting requirements. This had been achieved through enforcement of minimum scales of manning, an increased output from training and crucially 100 less first line aircraft at the end of 1943 than originally planned. There was a surplus in Supervisory rates and lower Airframe and Armourer trades, but the position was not so good in Engines and Electrical trades due to a higher failure rate during training. This improved situation would allow more supervisory ratings to be employed on instructional duties and provide greater stability for air stations in Britain and training squadrons which often bore the brunt of undermanning.¹⁰⁰ However there was caution against over confidence in the future: ‘Under the recent Cabinet ruling on manpower allocation, the Naval Air Arm is roughly 3,000 men short of meeting absolutely essential commitments prior to the defeat of Germany, and even this figure can only be achieved at the expense of emptying the pre-entry and technical training establishments.’¹⁰¹ Rear Admiral Bedale, DAMR, provided a perspective on the range of challenges on 26 May 1944:

⁹⁵ Minute by DPS, 10 Jan 1943, ADM 1/17468.

⁹⁶ Minute by DAMR, 15 Dec 1942, ADM 1/17468.

⁹⁷ Minute from First Lord to Prime Minister, 15 Jul 1943, ADM 1/14990.

⁹⁸ Note of Second Manning Priorities Meeting for Air Maintenance Ratings held by Fifth Sea Lord, 22 Sep 1943, ADM 1/12638.

⁹⁹ Minute by DAMR, 1 Sep 1943, ADM 1/16543.

¹⁰⁰ Minute by DPS, 31 Dec 1943, ADM 1/12651.

¹⁰¹ Ibid.

‘In Maintenance Personnel alone there has been an increase of nearly 100 per cent in the last twelve months... Further, the number of First Line operational aircraft types has more than doubled since last spring. Many of the new machines are of American design and construction, which, because of the inevitable differences, introduce special problems in maintenance and repair. In the case of one British machine [Barracuda], the defects have thrown far more work on this Department than could reasonably have been foreseen.’¹⁰²

Yet at the same time the delay at introducing more carriers and squadrons into service led to the Director of Personal Services to propose a further loan of personnel to the RAF:

‘The men are coming off training at the rate of 400/week and taking into consideration the formation of new 1st Line and Training Squadrons and monthly relief action to the Eastern Theatre, it would appear that we shall be able to lend the R.A.F. at least another 1000 men, with supervisors to the scale of 1 to 20 (i.e. 50)... the Air Ministry should be asked whether they would like the “loan”... on the same conditions as the present loan of 3000 odd.’¹⁰³

Bedale had no objection in principle but wished to avoid: ‘...any suggestion that the F.A.A. has made excessive demands for aircraft maintenance ratings.’¹⁰⁴ However, Captain Grantham, the Director of Plans, strongly opposed such a move declaring that he was ‘...strongly averse to disclosing gratuitously a temporary surplus of maintenance ratings. Without wishing to be a dog in manger. D. of P. would welcome the employment of the surplus in the Royal Navy, if D.P.S. can by any means arrange it.’¹⁰⁵ Naval ratings were already on loan to 41 Group RAF for the modification and preparation of naval aircraft for service overseas. However, the majority were retained by the navy with the prospect of taking over RAF Ayr and Evanton in September and further commitments at RAF maintenance units and the formation of Hellcat squadrons at RNAS Wingfield. It was not until December 1944 that 144 Air Mechanics were loaned to 24 Maintenance Unit of 43 Group help with the maintenance of naval aircraft.¹⁰⁶

The shortage of maintenance ratings at times during the war was highlighted by the position in the Far East. It was reported in July 1943 that: ‘Stations in East Africa, all of

¹⁰² Minute by DAMR, 26 May 1944, ADM 1/16543.

¹⁰³ Minute by DPS, 26 May 1944, ADM 1/16701.

¹⁰⁴ Minute by DAMR, 2 June 1944, ADM 1/16701.

¹⁰⁵ Minute by D of P, 21 June 1944, ADM 1/16701.

¹⁰⁶ Letter from DPS to Commodore RN Barracks Lee-on-Solent, 6 Dec 1944, ADM 1/16701.

which have been in commission for nearly twelve months are still far below complement, and those in Ceylon and India have received only about one tenth of their requirements.'¹⁰⁷ Overall there was a deficiency of 1251 ratings and priority for personnel was to be given to stations in India and Ceylon - Katukurunda, Coimbatore, Puttalam, Cochin and Colombo. Three months later it was confirmed that 1000 maintenance ratings would be sent although half of these were needed in Nairobi in East Africa.¹⁰⁸

In January 1944, Admiral Somerville, C-in-C Eastern Fleet, informed the Admiralty that to meet the planned expansion of his command he would require a further 700 maintenance ratings by 30 May, although 500 were now available from East Africa.¹⁰⁹ A further 250 ratings were despatched from the UK the following month. At the same time the Captain Lambe, Director of Plans, was pessimistic about repair facilities:

'...during the second half of 1944 the sum total of aircraft repair capacity in both S.E.A.C. and the S.W. Pacific will be insufficient to support the Naval Aircraft likely to be available in the area. Which portions of the available capacity can and will be manned it is impossible to forecast.'¹¹⁰

The shortages were such that by the end of 1944 plans were drawn up for the despatch of unskilled labour:

'It is understood that Their Lordships intend to dispatch to Ceylon at an early date some 1,000 naval personnel who will have received some preliminary training in aircraft repair work but will have little or no practical experience. It is also understood that no white civilian labour, no skilled native labour and indeed very little native labour of any description will be available in Ceylon.'¹¹¹

The situation in the Far East in 1944 may be contrasted by the apparent abundance of maintenance ratings in Britain where 3000 were on loan to the RAF, although a number of these were attached to RAF maintenance units which undertook work on naval aircraft.

To complete the expansion of the FAA up to 1946 including the manning of a further thirteen air stations, 17,000 maintenance personnel were needed to be transferred

¹⁰⁷ Letter from RANAS, IO to C-in-C, Eastern Fleet, 28 Jul 1943, ADM 1/14690.

¹⁰⁸ Note of Second Manning Priorities Meeting for Air Maintenance Ratings held by Fifth Sea Lord, 22 Sep 1943, ADM 1/12638.

¹⁰⁹ Message from C-in-C, Eastern Fleet to Admiralty, 29 Jan 1944, ADM 1/16406.

¹¹⁰ Minute by D of P, 4 Feb 1944, ADM 1/16406.

¹¹¹ Letter from Secretary of MAP to Secretary of Admiralty, 23 Dec 1944, ADM 1/24276.

from the Air Ministry at a rate of some 2,000 per month from January 1945.¹¹² Head of Air Branch noted in mid-December that up to the end of February 1945: ‘...we could meet about half of the total [manning commitment] as things stand at present... we shall not have much sanction behind our approach to the Air Ministry for the airfields unless we have got the men to put in them, especially as our shortage of maintenance ratings is well known to the Air Ministry.’¹¹³ So right until the end of the war the RAF continued to play an important role and Flight Mechanic Ronald Neal was one of 500 RAF mechanics and fitters transferred to the navy in May 1945. He was ordered to RAF Locking expecting to attend his Flight Engineer’s Course, but it turned out to be a one-month course on naval aircraft such as Avengers, Barracudas, Corsairs and Seafires: ‘A more reluctant bunch of trainees would have been hard to find! Everyone passed with better than 70% marks! Most would willingly have failed but were not allowed to!’¹¹⁴ Neal was then drafted to Gosling III at Havant and took part in a memorable changeover ceremony: ‘...whilst there we were taken to Portsmouth where we were “discharged from the RAF and called up for the RN” in about 30 seconds flat. A pair of RN Police armed with Sten guns ensured that no-one “did a runner”’.¹¹⁵

A notable addition to the expertise of naval maintenance personnel by the end of the war were experts from the leading manufacturers to advise on repairs and alterations to their equipment. In January 1944 representatives from four British firms; Bristol, Fairey, Rolls-Royce and Vickers, and ten North American firms; Canadian Car, Chance-Vought, Curtiss Props, General Motors, Grumman, Hamilton, Pratt & Whitney, Ranger, Sikorsky and Wright were advising FAA units. The majority were ashore, mostly in the Far East, but Mr Thomas Stanton of Chance-Vought embarked on HMS *Illustrious* in 1943 to provide assistance with the Corsair and Barracuda advisors Mr Hillard and Mr Knowler were embarked on *Illustrious* and *Furious* respectively.¹¹⁶ There were also discussions about the provision of repair parties of seventy men each from Vickers-Armstrong, Fairey and Blackburn to supplement naval maintenance personnel in the Far East. As Captain Jameson, Deputy Director of Aircraft Maintenance and Repair, remarked in October 1944 this practice was already followed in the RAF:

‘...Supermarine had already had to organise and maintain a large “On Site” Working Party to service the “Spitfires” operating with the Royal Air Force...

¹¹² Minute from Fifth Sea Lord to First Lord, 24 Nov 1944, ADM 1/17397.

¹¹³ Minute by Head of Air Branch, 18 Dec 1944, ADM 1/17397.

¹¹⁴ Letter by Ronald Neal to the author, 2 Aug 2004.

¹¹⁵ Ibid.

Some of them are already working overseas in France, Belgium, Holland etc. and there is little doubt that a considerably increased number will be required to go overseas... in the near future.'¹¹⁷

Approval for deployment of such repair parties with the navy was still pending at the end of hostilities.

Reorganisation of maintenance procedures

During the inter-war period squadrons were responsible for their own maintenance. With the small numbers of ships and squadrons before 1939, a system of self-contained squadron maintenance had prevailed with Squadron Commander in charge and enough stores and equipment were provided to enable the squadrons to undertake major inspections. As early as August 1938 the Senior RAF Officer on HMS *Furious* proposed that some sort of centralised system would lead to greater efficiency: 'Under the present system it is a daily occurrence for hundreds of skilled man hours to be wasted when squadron aircraft are flying, whereas under the suggested central scheme all skilled men would be employed in workshops on essential work.'¹¹⁸ In the first few years of the war the squadron maintenance remained effective since the aircraft were of comparatively simple design and there were enough experienced Petty Officers and Chief Petty Officers to manage the maintenance procedures. However, as the war progressed, squadrons expanded to up to twenty-four aircraft, the size and complexity of aircraft increased and there was a dilution of experienced maintenance personnel.¹¹⁹

In December 1941 the Commanding Officer of RNAS Worthy Down visited RAF stations at Brize Norton and Upavon where centralised maintenance was in operation and came away with a very positive impression. A six-month experiment was undertaken at Worthy Down during 1942 pooling the resources of No.1 Air Gunners School, 755, 756 and 757 Squadrons and the station workshop. An Air Engineer Officer was in charge of all repairs excluding daily inspections and minor running repairs. Initial results were encouraging: '...a high total of flying hours has been achieved and is being maintained.'¹²⁰

Advantages included the centralised control of all maintenance personnel, aircraft and stores and a greater co-ordination to maintain the required serviceability and flying

¹¹⁶ Minute by DAMR, 25 Jan 1944, ADM 1/17415.

¹¹⁷ Minute by DAMR, 20 Oct 1944, ADM 1/24276.

¹¹⁸ Memorandum 'Organisation of Training Carrier Units Based Ashore' from Senior RAF Officer, HMS *Furious* to CO, HMS *Furious*, 3 August 1938. ADM 1/9896.

¹¹⁹ Report from Naval Aircraft Maintenance Committee to Secretary of Admiralty, 30 Apr 1946. ADM 1/19264.

hours. Disadvantages of this system were the loss of personal relations between aircrew and maintenance personnel and their loss of interest in the performance of a particular aircraft. Pilot Gerard Woods commented: 'In 1942, for reasons of efficiency, "centralised maintenance" was introduced, a sort a garage system, removing pride of individual ownership, though obviously making economical use of maintenance personnel at a time when so much new technology was being introduced.'¹²¹ In accordance with the success at Worthy Down, the Binney Manpower Inquiry in January 1943 recommended an expansion of centralised maintenance procedures: 'Should this be made general throughout the Fleet Air Arm Training Stations, saving in personnel, especially highly trained ratings, will be made.'¹²² This did not prove possible in the short-term because of the large variety of types used for training. While there was no official change of policy, a system of centralised aircraft maintenance was adopted on several carriers commanded by an Air Engineer Officer; aboard the carrier HMS *Vindex* routine inspections and minor inspections undertaken by squadron ratings under the senior maintenance rating. More extensive work was done by a party under command of the Air Engineer Officer.¹²³ This allowed the Squadron and Wing Commanders to concentrate on operational tasks and permitted a pooling of manpower, tools and spares.

It was not until December 1945 that the Operational Research Section conducted a detailed investigation into the efficiency of the different types of maintenance regimes.¹²⁴ Eighteen air stations were visited of which eleven conducted squadron maintenance, two squadron centralised maintenance and five centralised maintenance. The average number of maintenance ratings per 1000 flying hours a month was 504 for squadron maintenance, 547 for squadron centralised maintenance and 412 for centralised maintenance. The highest was 637 for squadron maintenance at Easthaven and the lowest 335 for centralised maintenance at Yeovilton, the most efficient station.¹²⁵ As a result centralised maintenance was adopted as standard across the post-war Fleet Air Arm.

The other significant hangover from the squadron system was that maintenance personnel disembarked with their tools and equipment whenever the squadrons did so, to maintain the aircraft ashore. In peacetime this was acceptable when there were few squadrons many carriers spent long periods affiliated to the same station with the same air

¹²⁰ Report from CO, RNAS Worthy Down to RANAS, 10 Jun 1942, ADM 1/13569.

¹²¹ Gerald Woods, *Wings at Sea: A Fleet Air Arm Observer's War 1940-45* (London: Conway, 1985), 48-49.

¹²² Report by Binney Manpower Inquiry, Part II, 5 Jan 1943, ADM 1/13569.

¹²³ Report from CO, HMS *Vindex*, to C-in-C Western Approaches, 1 Jul 1944, ADM 1/16153.

¹²⁴ Report No.12 from Operational Research Section attached to Admiral (Air), December 1945, ADM 116/5699.

¹²⁵ See Appendix 4 for details of the maintenance at each station.

base, for example HMS *Hermes* on the China Station supported from Kai Tak airfield in Hong Kong. However, this system became unwieldy in wartime when squadrons were frequently disembarked in between operations to a variety of stations. For the aircraft this was reasonably easy but the maintenance personnel had to locate transport for bulky stores and tools often arriving at the base airfield days after the aircraft; a typical routine is demonstrated by 835 Squadron which arrived in the Clyde on 15 April 1942:

‘The four Swordfish flew off and we made our way via RN Air Station Machrihanish and RAF Sealand to RN Air Station, Lee-on-Solent, near Gosport where we landed at 1700. Meanwhile Jack Teesdale [Stores Officer] was inevitably left to pack up and arrange for the disembarkation of the ground party and stores at Greenock from which they departed at 1640 on 16th April and duly arrived at Lee-on-Solent via Glasgow, London and Portsmouth at 1300 the following day.’¹²⁶

In addition the quantity of Squadron Mobile Equipment (SME) had reached such proportions by 1943 that it had become a misnomer:

‘...the bulk of Squadron Mobile Equipment items are essential for the efficient maintenance of the Squadrons; and although it has been found possible to reduce certain heavy items (e.g. Aeroplane Inspection Platforms), the total remaining equipment is far too great for Squadrons so encumbered to be truthfully termed mobile.’¹²⁷

Therefore it was proposed to form a number of Squadron Servicing Units (SSUs). These units moved between air stations to where they were needed and were responsible for conducting minor inspections on squadrons as they flew ashore. Each SSU was equipped with enough stores to maintain twelve aircraft for fourteen days. No.1 SSU was attached to 897 Squadron at RNAS St Merryn on 9 May 1943 for one month’s trial and following its success Captain Byas, DNAO, proposed the formation of nineteen SSUs. The first Seafire SSU would be allocated to RNAS Lee-on-Solent and the first Barracuda SSU to RNAS Donibristle. Other stations to receive SSUs included RNAS Eglinton, Hatston and Stretton. To concentrate the availability of spares and equipment certain stations were to concentrate on fighters and others on strike aircraft. SSU’s would be allocated to stations which did not

¹²⁶ E.E. Barringer, *The 835 Story*, 33-34, IWM/Doc 91/17/1.

¹²⁷ Letter from RANAS to Secretary of Admiralty, 25 Feb 1943, ADM 1/13612.

normally host disembarked units: 'S.S.U's will not be required at the stations (e.g. Machrihanish) normally used for the reception of disembarked squadrons as these normally carry stocks of type stores.'¹²⁸

While the SSU provided useful assistance for squadrons flying ashore, there was little that could be done about the quantity of SME as E.S. Wood, Director of Stores noted in January 1945: '...proposals put forward during the war years towards effecting substantial reductions in S.M.E. have not been supported by other departments mainly on account of the tendency to detach squadrons to remote R.A.F. stations where maintenance and servicing facilities were negligible or non-existent.'¹²⁹ That the problem continued to afflict carriers is illustrated by an incident in HMS *Venerable* in February 1945: 'A squadron has been known to arrive... with a range of S.M.E. permanent and consumable spares of over 900 items. It had to be relieved at once of most of its packing cases which had reduced the hangar aircraft accommodation by three aircraft.'¹³⁰

Influence of American practice

The FAA's first detailed exposure to American maintenance practice occurred during the attachment of HMS *Victorious* to the US Pacific Fleet in 1943 when very different procedures became apparent. The USN operated on the theory of cure rather than prevention and therefore the thirty-hour inspections were perfunctory taking only two to six hours. Captain Wright, DAWT, noted that:

'...the Americans have always favoured the "Never repair – scrap and replace principle, they probably accept a short aircraft life. Hence "in the long run" is of no particular importance; what matters is a high degree of serviceability for immediate operations and this they seem able to produce.'¹³¹

Many of the American mechanics had between two and four years carrier experience and there was no dilution of skilled personnel as had taken place in the FAA.¹³² It was estimated that the American maintenance scheme involved double the number of personnel and Vice Admiral Lyster, Flag Officer Carrier Training, believed that it would not have suited the FAA in the early years of the war: 'Efficient as it may be, there is one possible disadvantage, in as much as such an organisation must tend to make squadrons very

¹²⁸ Minute by Director of Stores, 27 Aug 1943, ADM 1/13612.

¹²⁹ Minute by Director of Stores, 12 Jan 1945, ADM 1/17523.

¹³⁰ Paper from Captain E.L. Tottenham to DAE, 5 May 1945, ADM 1/17523.

¹³¹ Minute from DAWT to Fifth Sea Lord, 20 Sep 1943, ADM 199/838.

dependent on outside personnel and will detract from the self-reliance which had stood us in good stead in such fields as the Western Desert, Crete and Greece.’¹³³ Air Mechanic George Amyes based at Lewiston, Maine in 1943 recalled the lavish American practice of maintaining Avenger engines:

‘...being British... you work on every part of the engine... They [the Americans] had the engines split up into about sixteen different sections. There were about sixteen different men working on one machine where we just had the one... The economy of waste out there was something fantastic. They used to unship and refit new engines just for the slightest fault...’¹³⁴

Air Artificer Stuart Bridges was certainly aware of the American ‘never repair – scrap and replace’ policy from a particular problem that he encountered when working on the Corsair:

‘...if ever you were involved in a mainplane change, there was a sheet metal fillet between the actual wing and the fuselage... which went right round the top and bottom of the wing, was held in place by literally hundreds of 2BA bolts each one of which had to be unscrewed before you could get in at the joining parts of the wing to the airframe... we were not over impressed with that particular design.’¹³⁵

The USN commissioned the Radford Report in 1944 to advise on the future of aircraft maintenance and it recommended that: ‘the life of individual Naval aircraft in combat areas should be limited to a period when it would be no longer economical in local effort to repair them, Combat Units being provided with a sufficiency of replacement aircraft to implement this policy and less spare parts for repairs.’¹³⁶ Mr Massey Hilton, a Fairey Director, visited the East Indies Station in 1945 to report on aircraft maintenance and approved of the American repair policy:

‘Minor repair of components is done, but nothing of a major nature or likely to absorb more than 2,000 man hours per aeroplane. If the total damage is greater than this figure, the aeroplane is reduced to produce or scrap... In view of the

¹³² Report from CO, 832 Squadron to Commander (Flying), HMS Victorious, 1 Aug 1943, ADM 199/838.

¹³³ Minute from FOCT to Fifth Sea Lord, 19 Sep 1943, ADM 199/838.

¹³⁴ G.A. Amyes, IWM/SA 16355, Reel 4.

¹³⁵ S. Bridges, IWM/SA 21184, Reel 1.

¹³⁶ Reference sheet from Head of Air Branch to First Lord's Private Office, 12 Aug 1944, ADM 1/17149.

various adverse factors (shortage of experienced personnel and repair facilities generally, climate etc) I think this policy is the right one.’¹³⁷

It was not until the operations of the British Pacific Fleet in 1945 that the system of ‘scrap and replace’ was really adopted by the Royal Navy since the carriers were at sea for long periods and so the only possible repairs were those within a carrier’s capabilities.

Supply of air stores

The problems in estimating the supply of air stores to squadrons throughout the war was highlighted as a serious issue by the post-war Naval Aircraft Maintenance Committee report in 1946:

‘We consider that in time of war having too many stores is an even greater evil than having too few. Where there are shortages the fault is readily diagnosed and the remedy is obvious. A build up of superfluous stores is not so easily noticed, but at some stage the whole organisation for storage and distribution becomes choked. Curing this ill is extremely difficult.’¹³⁸

The Director of Stores noted in December 1940: ‘...numerous Swordfish aircraft have reported deficiencies... during the last few months. The importance of these shortages is enhanced by the difficulty of obtaining spares from contractors. Supplies have been on order for a lengthy period but it is virtually impossible to obtain deliveries.’¹³⁹ In the early years of the war the orders for aircraft and spares were not generally well co-ordinated and it took some time for firms to take orders for air stores particularly seriously as an Admiralty report commented in January 1943: ‘...from a monetary point of view it was not now more profitable to a Firm to produce completed aircraft than spares. The psychological aspect of this matter ought not, however, to be overlooked as there was no doubt that a worker in a factory felt that his efforts were better repaid in seeing a completed aircraft flown away than the parts he has made packed up as spares.’¹⁴⁰

As the service expanded the problem of providing sufficient air stores and equipment was compounded by the fact that in November 1943 there were sixty-two different aircraft types among the total of 2198 aircraft for first line and training duties.¹⁴¹

¹³⁷ Report from Mr Massey Hilton to FONAS (A), East Indies Station, 15 Jan 1945, ADM 1/17430.

¹³⁸ Report by Naval Aircraft Maintenance Committee to Secretary of Admiralty, 30 Apr 1946, ADM 1/19264.

¹³⁹ Letter from Director of Stores to RANAS, 23 Dec 1940, ADM 1/11148.

¹⁴⁰ Report of meeting held by RANAS, 4 Jan 1943, ADM 1/16451.

¹⁴¹ Minute by DAMR, 12 Nov 1943, ADM 1/13640.

The Director of Stores noted: 'It will be almost impossible, unless the number of types in general use is restricted to the utmost, to avoid serious breakdowns due to the impracticability of providing spares for a large diversity of types at a great number of stations, repair yards, etc., spread all over the Eastern Theatre.'¹⁴² At the same time the Directors of Air Equipment and Stores complained that the forecasts for the distribution of equipment required improvement to enable the timely supply of stores and for the arrangement for shipping of aircraft consignments.¹⁴³ They predicted that the most serious problems would be encountered in the Far East because of the wide geographical spread of FAA activity: '...it would be essential, if requirements were to be met, for the supply aspect to be held closely in view at every stage of planning both long term policies and the day-to-day movements and allocations of aircraft in the preparatory stages.'¹⁴⁴ Captain Byas, DNAO replied that the six month distribution forecast was updated monthly and the long-term two-year forecast updated every six months.¹⁴⁵

Procurement of stores for certain types were problematic and the Director of Stores complained in August 1944 about the availability of Barracuda spares: 'The position continues to be unsatisfactory, especially of certain Minor Spares. The full seriousness of the position has been impressed on the contractors, and...to concentrate as far as possible on items for which there is known expenditure will lead to some improvement.'¹⁴⁶ Supplies of spares for American aircraft for the FAA and RAF were organised by the British Aviation Supply Depot in Philadelphia: 'During the three years life of the Depot between 500,000 and 600,000 cases of stores were received, approximating to 60,000 tons, more than half of which was for the Royal Navy.'¹⁴⁷ Between January 1944 and August 1945 the Depot despatched 193,029 cases of air stores for the FAA.¹⁴⁸ When the US Navy introduced new principles of maintenance in the spring of 1944 under the Radford Report, which concluded that it was more efficient to produce new aircraft than repair old ones, supplies of large types of spares to the FAA were reduced.¹⁴⁹

The future of the Naval Air Arm Supply Organisation was considered by the Baliol-Scott, Chisholm and Coxwell Committees all of which recommended the continuation of the organisation in its existing form. The Baliol-Scott Committee in August 1944 concluded that the Naval Store Department was faced with: '...a prodigious increase

¹⁴² Minute by Director of Stores, 20 Nov 1943, ADM 1/13640.

¹⁴³ Minute by DAE and Director of Stores, 16 Nov 1943, ADM 1/15392.

¹⁴⁴ Minutes by DAE and Director of Stores, 4-7 Dec 1943, ADM 1/15391.

¹⁴⁵ Minute by DNAO, 29 Jan 1944, ADM 1/15392.

¹⁴⁶ Report by Director of Stores, 5 Aug 1944, ADM 1/17149.

¹⁴⁷ History of the Naval Store Department in North America, Chapter XXXVI, ADM 116/5813.

¹⁴⁸ Reports by BAD Washington, 1944-1945, ADM 199/1470 & 199/1471.

in the range of stores... due particularly to the rapid development of radio and scientific equipment of many descriptions, and also to the great expansion of the Fleet Air Arm, for which it had to supply a vast range of spare parts.'¹⁵⁰ It blamed the Air Ministry and its successor, the Ministry of Aircraft Production for the lack of spares for the FAA: '...the failure of the procuring organisation to meet requisitions is apparently attributable, to a large extent, for the chronic condition of short supply which appears to prevail in the case of numerous air stores.'¹⁵¹ Given the numerous complications which attended the supply of air stores it is unsurprising that a number of squadrons retained more stores than were actually required because of the likelihood that further supplies might not be forthcoming.

Experience of maintenance afloat

While maintenance personnel are not generally regarded as being in the front line Air Mechanic (Engines) William Churchouse had an experience perhaps unique in the FAA; between August - December 1941 he was on three ships which were torpedoed and sunk. First SS *Aguila* on 13 August taking him out to Gibraltar, then on HMS *Ark Royal* on 13 November and finally HMS *Audacity* on 19 December taking passage back to Britain. On his return to Britain Churchouse was appointed to RNAS Yeovilton and very much appreciated not being sent to sea again during the war.¹⁵²

Air Fitter Ted Whitley served in 819 Squadron aboard *Illustrious* in 1940 and played a notable role in the Taranto raid, one of the FAA's most famous actions. Each aircraft had two dedicated maintenance personnel and with the Swordfish flying anti-submarine patrols from dawn until dusk the workload was considerable: '...the 30-hour Minor Inspections came round in less than a week. There were no laundries, no night flying rations and, as the mess decks were at sea level, the maintainers slept in the hangar on camp beds.'¹⁵³ By the time of the Taranto attack Whitley had been promoted Leading Air Fitter in and was in charge of airframe servicing for six Swordfish. When there was a deck collision among the second wave of aircraft for the Taranto raid it was Whitley's decision, as he puts it of: 'A not quite 19 year old Leading Air Fitter, which aircraft went & which didn't... With my chum Wilf Jones & RAF Sgt Sinfield we made the temporary repair that let Lts Clifford & Going visit Taranto on their own twenty minutes after the rest.'¹⁵⁴

¹⁴⁹ History of the Naval Store Department in North America, Chapter XXXVI, ADM 116/5813.

¹⁵⁰ Report on Naval Store Department by Baloil-Scott Committee, 14 Aug 1944, ADM 1/16521.

¹⁵¹ Ibid.

¹⁵² W.J. Churchouse, IWM/SA 13749, Reel 1.

¹⁵³ Letter from Ted Whitley to the author, 1 Aug 2004.

¹⁵⁴ Ibid.

Acting Air Artificer 4th Class Cyril Tapley served with 820 Squadron on HMS *Formidable* during Operation 'Torch' and found himself kept similarly busy to keep two Albacores continuously on patrol:

'The atmosphere in the hangar was not really conducive to sleep. There was far too much activity, but I had procured a "safari" camp bed and used this in order to snatch a few hours rest in between our aircraft taking off and landing... The whole squadron had been working flat out in order to keep all twelve aircraft fully serviceable since we had left the Clyde.'¹⁵⁵

HMS *Illustrious* and HMS *Formidable* supported Operation 'Avalanche' between 9-11 September 1943 and maintained eight fighters continuously in the air for three days completing 209 deck landings on *Illustrious* and 214 on *Formidable*. Maintenance requirements would have limited a longer effort: '...the full effort could probably have been maintained for one more day in FORMIDABLE and 3 more days in ILLUSTRIOUS. Some extension of time to 30 hour inspection would have been required in both ships.'¹⁵⁶ During the infamous operations of Force V at the same time the supply of spares was adequate with the exception of propellers which ran short due to the large number of Seafire accidents.¹⁵⁷ It was not always the case that maintenance ratings were overworked. Ten maintenance ratings were needed for CVEs employed in the ferrying role¹⁵⁸ and Petty Officer Air Artificer Joe Ainley was assigned to HMS *Ruler* in 1944:

'I was now serving in an aircraft carrier – with no [operational] aircraft. As a well trained and experienced maintenance tradesman Air Artificer and the senior rate in a workshop with sheet metal and allied equipment, I had to come to terms with this situation. It was a cushy number but I am industrious by nature, so whatever I could make, I did.'¹⁵⁹

Aircrew often expressed their appreciation of the efforts of maintenance personnel. Midshipman Charles Friend of 810 Squadron on *Ark Royal* in 1940 recalled his first spell as Squadron Duty Officer:

¹⁵⁵ Tapley, *Tango for a Sailor*, 108.

¹⁵⁶ Report from RA, Aircraft Carriers, Home Fleet to FOC, Force H, 14 Sep 1943, ADM 199/862.

¹⁵⁷ Note of meeting held by ACNS (A), 20 Oct 1943, ADM 1/12640.

¹⁵⁸ Telegram from Head of Military Branch II to BAD Washington, 27 September 1943, ADM 1/13752.

¹⁵⁹ *Ruler's Reign* Chapter 9, p.5.

‘...I could depend utterly on the Flight Sergeant or Chief Petty Officer to organise the work, and with one exception... I found that our maintenance people, fitters, riggers, armourers and electricians and so on were totally responsible, and dedicated to keeping “their” aeroplanes at peak performance and fiercely competitive in doing so.’¹⁶⁰

Lieutenant ‘Percy’ Gick, was Senior Pilot of 825 Squadron assigned to *Victorious* in May 1941 at short notice for operations against the *Bismarck*: ‘...we got this panic order to get on board *Victorious* and as Senior Pilot I had a slight problem because *Victorious* had absolutely no Swordfish stores at all. She was stored entirely for Albacores. Fortunately at that time I knew all the stores people fairly well and they did a super job...’¹⁶¹

An entirely more unsavoury incident occurred aboard HMS *Ark Royal* in September 1941 when Swordfish V.4414 of 810 Squadron made an emergency landing while on anti-submarine patrol. The pilot reported failing oil pressure and undissolved brown sugar was found in the oil tank and oil filters. After an investigation by Instructor Commander Benstead, Air Mechanics Ernest Howe, Francis Burrage and James Walton were placed under close arrest.¹⁶² Walton was soon cleared and released, however, Air Mechanic High Woolley was also implicated and arrested. There was insufficient evidence for a court martial, but Howe and Burrage were discharged and Woolley re-drafted. In addition to poor morale and discipline in 810 Squadron, Benstead highlighted that Squadron Officers took no interest in the welfare of the men. There was a general state of dirtiness and untidiness among the men and their equipment, a lack of aptitude among the leading hands and a general low level of technical efficiency.¹⁶³ The Director of Personal Services concluded that 810 Squadron: ‘...appears to have consisted largely of a gang of undisciplined rascals none of whom should be retained in the Naval Service.’¹⁶⁴ Admiral Lyster, the Fifth Sea Lord, recommended drastic action: ‘...810 Squadron is to be disbanded and reformed with fresh personnel who have not been connected with the squadron during this black period in its history.’¹⁶⁵ In addition to the Navy’s insistence on high standards of maintenance, Petty Officer K.R. Avery who served aboard HMS *Stalker* from March 1942 - January 1944 recalled the strict precautions precautions when planes were being refuelled:

¹⁶⁰ C. Friend, *Only Friend survived the war: The story of a seven year commission in the Fleet Air Arm 1939-1946*, 30, IWM/Doc 86/37/1.

¹⁶¹ P.D. Gick, IWM/SA 12097, Reel 1.

¹⁶² Report from CO, HMS *Ark Royal* to Director of Naval Intelligence, 17 Oct 1941, ADM 178/269.

¹⁶³ Report by Instructor Commander Benstead, 11 Oct 1941, ADM 178/269.

¹⁶⁴ Minute by DPS, 9 Dec 1941, ADM 178/269.

‘When planes were being refuelled, there was a strict rule of No Smoking, with imprisonment for the transgressors. To my knowledge two ratings had imprisonment for this offence and one Officer who forgot he had a lighter on him, which fell out of his pocket in the hangar... lost twelve months’ seniority.’¹⁶⁶

One issue which was raised by carriers on a number of occasions was when they received aircraft which had been poorly maintained. HMS *Ark Royal* received six Swordfish from Gibraltar of 821 Squadron which were due to be flown off to Malta two days later. Unfortunately five had not been fitted with long range tanks and three had defective torpedo equipment. In addition both the Vickers guns and bomb carriers were rusting.¹⁶⁷ Four Fulmars received by the ship around the same time were also found to be in poor condition loaded with out-of-date ammunition and one with a defective rear gun. Admiral Somerville commanding Force H noted: ‘...the fighting efficiency of H.M.S. ARK ROYAL... is largely dependent on the ability to bring into action replacement aircraft in the minimum time after their receipt.’¹⁶⁸ Five months later three Sea Hurricanes were transported to Gibraltar on board *Furious*, but could not be embarked in *Ark Royal* as planned since there were no spares, tools or technical publications for Hurricanes on the ship which meant it would have been almost impossible to keep them serviceable.¹⁶⁹

Experience of maintenance ashore

Since the squadrons of the FAA were equipped to operate from carriers, the need to operate ashore in the Mediterranean presented a number of unusual difficulties. After the sinking of HMS *Ark Royal* in November 1941, Acting Lieutenant Commander ‘Percy’ Gick, was sent out to take command of 815 Squadron, which was based at Maaten Bagush in the Western Desert:

‘...we spent a couple of days scouring round the Desert just after the Italians and Germans had been driven back picking up masses of vehicles... we had Italian lorries, German lorries and staff cars... I found that there were half a dozen cooks, Italian cooks, who had all worked in major London restaurants and six fitters who had been the Alfa Romeo racing team and we were allowed to have them at

¹⁶⁵ Minute by Fifth Sea Lord, 1 Jan 1942, ADM 178/269.

¹⁶⁶ K.R. Avery, *A Dose of Salts*, 301-302, IWM/Doc 87/46/1.

¹⁶⁷ Report from CO, HMS *Ark Royal* to FOC, Force H, 16 Jan 1941, ADM 1/11148.

¹⁶⁸ Letter from FOC, Force H to Secretary of Admiralty, 14 Jun 1941, ADM 1/11148.

¹⁶⁹ Report from CO, HMS *Ark Royal* to Secretary of Admiralty, 31 Jul 1941, ADM 199/847.

Dekheila, not up in the Desert. But we just popped them in the back of an aircraft and flew them up and they were absolutely marvellous.’¹⁷⁰

826 Squadron was disembarked after HMS *Formidable* was damaged on 25 May 1941 and Lieutenant Haworth recalled a similar tale of improvisation:

‘The first problem... was to make the Squadron self sufficient and mobile so that could operate under the RAF in the western desert without returning to base at Dekheila except for major aircraft inspections. The necessary motor transport was not available from Naval or RAF sources, but by dint of scrounging from every conceivable Army unit, a motley collection of vehicles was assembled, the prize being a large Italian diesel lorry proved invaluable for carrying bombs... other essentials were enough tents to house some 120 Officers and men, camp beds and cooking utensils.’¹⁷¹

826 Squadron was still dependent on RAF maintenance personnel and Haworth was extremely complementary about their organisation:

‘We were fortunate in having a selection of RAF other ranks for aircraft maintenance, since the recently formed Fleet Air Arm had not yet trained their own ratings. The Flight Sergeant combined the qualities of administrator, disciplinarian and technical expert... In addition we had four Sergeants in charge of engines, airframes, armament and electrics – all of them first class at their job and suitable for Officer status...’¹⁷²

Sub-Lieutenant Swanton was an Observer in 821 Squadron, which arrived at Dekheila in Egypt on 9 January 1942. 821 Squadron operated from a variety of small landing strips in the Western Desert, one being Maarten Bagush, some 100 miles west of Alexandria:

‘...all work on the engines and airframes had to be carried out in the open. Sometimes a canvas screen was rigged if it became necessary to change a component while sand was blowing around. It was hot and uncomfortable, but

¹⁷⁰ P.D. Gick, IWM/SA 12097, Reel 2.

¹⁷¹ Captain M.G. Haworth, *My Cushy War: Memoirs of World War II*, 23, IWM/Doc 95 5/1.

¹⁷² *Ibid.*

under the circumstances the maintenance crews did a splendid job in very trying conditions.’¹⁷³

Between 7-9 May, 1941 814 Squadron took part in one of the most unusual FAA operations of the war when six Swordfish with a maintenance party of one Party Officer and seven Mechanics were disembarked from HMS *Hermes* to Shaibah in southern Iraq to assist British forces in putting down a rebellion. They remained there until 18 May flying a total of 253 hours. Aircraft were afflicted by a number of problems including bomb carriers failing to operate due to the very high temperatures and dust. Aircraft returned to *Hermes* for thirty-hour inspections, but the overall serviceability was accorded to good fortune rather than planning: ‘Although the Squadron managed to achieve a total of 6 serviceable aircraft ashore at all times, it is most strongly emphasised that this must be regarded as quite exceptional... it is incorrect from every practicable point of view to separate the operational unit of a Squadron from the maintenance units...’¹⁷⁴

The same squadron spent a rather more unplanned period ashore in Ceylon in 1942. Major Norrie Martin, Royal Marines, was Commanding Officer, 814 Squadron and Lieutenant Commander (Flying) of HMS *Hermes* when the squadron had been put ashore to Kokkalai before the ship was sunk on 9 April. The squadron was left with eleven aircraft, but only six maintenance personnel, the remainder with all the spares and tools having been left on board.¹⁷⁵ The following day Martin flew first to China Bay to inspect the damage and then on to Naval Headquarters in Colombo where he was: ‘...told the shattering news that the Far Eastern Fleet had withdrawn to Mombasa in East Africa and that I and my 10 pilots were to act, under R.A.F. orders, as Dive Bombers to repel the Japanese invasion, when it came!’ With no carriers on which to embark the squadron remained in Ceylon until December 1942.

In contrast for the FAA squadrons which operated in Britain with Coastal Command the maintenance facilities and supplies of stores were good. In July 1944, 848 Squadron operating under 16 Group at RAF Manston in support of Overlord achieved a serviceability rate of eighty per cent: ‘The Squadron has had adequate supplies of spare parts due to the listing as a “Limousine” Squadron.’¹⁷⁶ The squadron reported that the stores and spares situation had been helped considerably by the arrival of Avenger SSU No.2 the previous month. 854 Squadron flying from RAF Hawkinge at the same time reported serviceability

¹⁷³ A. Swanton, *The Other Side of the Coin*, 11, IWM/Doc 92/5/1.

¹⁷⁴ Report from CO, HMS *Hermes* to C-in-C East Indies, 24 May 1941, ADM 1/11459.

¹⁷⁵ W.H.N. Martin, *Memoirs*, 47, IWM/Doc 98/1/1.

averaging ninety per cent.¹⁷⁷ Lieutenant Ronald Gellatly, the Senior Pilot in 819 Squadron, noted the unusual maintenance organisation in operation when the squadron operated from airfields in Belgium on anti-E-boat patrols in the autumn of 1944:

‘Eventually room was found for us at St. Croix, near Bruges just behind the front line at that time. Accommodation there was limited as the ‘drome had just been captured, so it was decided that the Albacore Squadron and ourselves would only send a flight each over at first, keeping Bircham Newton as a maintenance centre, for major overhauls and repairs and a pool of aircraft...’¹⁷⁸

Seven Swordfish were initially flown over to St Croix, moving a while later to the airfield at Maldagem. Replacements aircrews went sent over from Bircham Newton in Kent from the end of November and from January 1945 all the squadrons’ aircraft and maintenance crews were based at Knocke on the Belgian coast.

Conclusion

Aircraft maintenance is a topic that has been frequently overlooked and it is especially interesting to examine how this was carried out at the beginning in the early years of aviation and the wide-range of roles that maintenance personnel carried out during that period. In both wars maintenance ratings were placed under considerable pressure by the intensity of operations while problems caused by a shortage of spares or operating in challenging conditions were similarly familiar. There was a very close relationship between the navy and industry at the beginning of the First World War when aircraft were returned to manufacturers for repairs and by 1943 manufacturers were providing engineers in the field to advise on the maintenance of certain aircraft types. The challenge of changing an organisation and procedures in wartime was shown by the inability of the FAA to establish its own facilities to train maintenance ratings and the only partial introduction of centralised maintenance, despite its apparent success.

¹⁷⁶ Report of Proceedings for Jul 1944 from CO, 848 Squadron, to Secretary of Admiralty, 6 Aug 1944. ADM 199/839.

¹⁷⁷ Report of Proceedings for Jul 1944 from CO, 854 Squadron, to Secretary of Admiralty, 1 Aug 1944. ADM 199/839.

¹⁷⁸ R. S. Gellatly, 176, IWM/Doc P13.

Chapter 7 – Conclusion: Pacific Endurance

The Experience of the British Pacific Fleet

Overview

It is proposed to bring together the various aspects of logistic provision which have been analysed in the previous chapters with a study of the most ambitious FAA operations in the period under review, those of the British Pacific Fleet (BPF) in 1945. The operations of the BPF highlighted naval logistic requirements because of the need for extensive support afloat – the Fleet Train – in addition to naval bases while the FAA also required a substantial logistic tail to maintain its carriers in action.

The strategic decision to deploy a Pacific fleet was not taken until the Octagon conference in September 1944.¹ The considerable bases built up in Ceylon and Southern India bases were 2000 miles from Australia, the main base for Pacific operations, and that in turn was up to 5000 miles away from the operational area. As result of the failure of the British aircraft industry to produce machines combining endurance, high performance and the robustness required for deck landings, the most noticeable feature of the fleet's aircraft on commencing operations in March 1945 was that 70% of them were American-built. The Avenger dive-bombers and Corsair and Hellcat fighters had longer ranges and were more versatile for Pacific operations, the Corsairs and Hellcats being used as fighter-bombers.

Operationally the Pacific commitment saw the allocation of a large part of the FAA's resources and all six of the navy's fleet carriers were involved. As the fleet remained at sea in the operations zone for up to month several CVEs were allocated to ferry replacement aircraft to the operational units. Some of these were stripped of their squadrons, with their aircrew utilised as replacements for the front line carriers. Tactically, it was a unique situation for FAA in the Second World War as the aircraft had to be maintained afloat for far longer than normal. Carriers adopted the system of centralised aircraft maintenance under the command of Air Engineer officers while there was a policy of aircraft replacement rather than repair with damaged machines being pushed over the side and replacement aircraft flown over from one of the replenishment carriers.

The operations in perspective

During the spring and summer of 1945 the BPF supported the invasion of Okinawa, Operation 'Iceberg', between 26 March - 25 May and deployed off the Japanese coast in

¹ For details of Octagon see Chiefs of Staff Record of Proceedings: 'Octagon' Conference at Quebec, 5 - 20 Sep 1945, PREM 3/329/4.

the July/August operations from 17 July - 10 August. With four Fleet Carriers on station at any one time carrying between 230-250 aircraft, the First Aircraft Carrier Squadron (1st ACS) was the spearhead of British effort in a theatre dominated by air power since day one.² Its operations had no precedent in the Royal Navy's history and in July and August 1945, the BPF conducted the most sustained and intensive air operations in the history of the Royal Navy. On four out of eight strike days in a twenty-three day period, the First Aircraft Carrier Squadron³ mounted more than 200 offensive sorties over Japan, the record being 254 on 9 August.⁴ HMS *Implacable* launched 130 sorties on 30 July, the greatest number by a British carrier on any single day of the war. As Admiral Bruce Fraser, Commander-in-Chief of the BPF noted, air power was very much in the ascendancy in the Pacific war and gunnery afforded secondary importance: 'The nature of the Pacific War with its absence of surface targets meant that the bombardment became the only offensive role of the gun.'⁵

While this period was operationally remarkable in the light of the FAA's previous experiences, the greatest achievement was in the field of logistic support; the fleet was located off the coast of Japan, 2,500 miles from the nearest air base at Manus, 5,000 miles from the main base in Australia and 17,000 miles from the United Kingdom. In Australia and the forward area were eight CVEs, five aircraft maintenance and repair ships and eight Mobile Naval Air Bases (MONABs) manned by 15,000 personnel to support some 250 front-line aircraft aboard four Fleet Carriers. The seven bases in Australia were provided by the Royal Australian Air Force and the advanced base at Manus in the Admiralty Islands was built and maintained by the United States Navy. These contributions were crucial since the Royal Navy lacked any organisation to construct airfields abroad, and the Pacific operations were approved at relatively short notice.⁶ Aircraft losses in the operational area amounted to 334 planes and 235 replacements were supplied to the fleet, in addition to new aircrew and aircraft spares. Since the losses in the last period of each operation did not require replacing, the majority of requirements were successfully met.

Carriers had previously conducted short haul operations before returning to base. Of eleven carrier operations between March - October 1944 each lasted an average of only

² Carriers on station:

'Iceberg' – Formidable (from 14 April), Illustrious (until 14 April), Indefatigable & Victorious. July/August – Formidable (until 11 August), Implacable (until 11 August), Indefatigable (from 20 July), Victorious (until 11 August).

³ HMS Formidable, Implacable, Indefatigable & Victorious.

⁴ Report from C-in-C, BPF to Admiralty, 6 Nov 1945; enclosure. report No.FORO 9 by Fleet Operational Research Officer of 15 Oct 1945, ADM 199/118.

⁵ Report from C-in-C, BPF to Admiralty, 6 Nov 1945, ADM 199/1478.

seven days with a total of 940 sorties in all these operations combined.⁷ Never before had carriers spent a month at sea between 700 - 2500 miles from the nearest land-based support. Twelve strike days were mounted during 'Iceberg One', 26 March - 20 April, a similar number for 'Iceberg Two', 4 - 25 May, and eight between 17 July - 10 August.⁸ During this time an unprecedented 7,500 sorties were launched. Without a regular supply of aircraft and associated stores the carriers and hence the *raison d'être* for the whole BPF would have been rendered impotent within weeks.

There were four stages in the air logistic chain which by July 1945 extended some 17,000 miles from the United Kingdom to south of Honshu Island. First the transportation of the raw materials - aircraft, either packed or erected, and their associated spares - out to Sydney, 12,000 miles from Britain, and from America and the Indian Ocean. In Australia were the means 'to process the material'⁹ and store reserve aircraft, an organisation which comprised six MONABs and a Transportable Aircraft Repair Yard (TAMY). Forward of Australia was the Forward Area Naval Air Station at Manus in the Admiralty Islands and support afloat in the shape of the Fleet Air Maintenance Group (FAMG). CVE's acted as ferry carriers from Australia to the forward base and in the replenishment role onwards to the fleet.

An agreement between Admirals Nimitz and Fraser on 20 December 1944, estimated that based on US practice, replacements required by the BPF would be 20% aircraft and 15% aircraft engines per month; for the BPF this amounted to around 50 aircraft per month.¹⁰ A minimum of a month's supply of replacement aircraft were recommended at the forward base with two ferry CVE's shuttling between this base and Australia. The availability of airfield facilities at Espiritu Santo in the New Hebrides and Manus, Admiralty Islands, were confirmed.¹¹

⁶ The decision to deploy a British Pacific Fleet was not taken until the Octagon Conference in September 1944. The fleet arrived in Sydney in February 1945.

⁷ Report No.60/45 'Analysis of British carrier strikes, 1944' by Directorate of Naval Operational Studies, May 1945, ADM 219/262.

⁸ Strike days were:

'Iceberg One': 26-27 March, 31 March - 2 April, 6-7, 12-13, 16-17 & 20 April

'Iceberg Two': 4-5, 8-9, 12-13, 16-17, 20-21 & 24-25 May.

July/August operations: 17-18, 24-25, 28 & 30 July, 9-10 August.

⁹ Unpublished notes on Staff History of British Naval Aviation, 1919-1945, Volume 3, 573, NHB.

¹⁰ Admiral Chester W. Nimitz, Commander Pacific Ocean Area and Admiral Sir Bruce Fraser, Commander-in-Chief, British Pacific Fleet.

¹¹ Memorandum of record of understandings reached in conference of 17-19 Dec 1944 concerning employment of British Pacific Fleet, 20 Dec 1944, ADM 199/1742.

Transportation of aircraft and spares to Australia

Transportation of spare aircraft to the Pacific from the UK involved the Air Ministry, RAF, War Office and Ministry of War Transport in addition to the Admiralty and units of the RN.¹² Naval aircraft requirements were submitted by the Admiralty two months in advance and details forwarded to the War Office and Ministry of War Transport for allocation of shipping space.

The RAF had been responsible for the packing and embarkation of aircraft for naval service abroad since 1941. The sole task of No.76 Maintenance Unit (76 MU) based at RAF Wroughton was to pack single-engined naval aircraft.¹³ Multi-engined planes were packed by the appropriate RAF unit since all were ex-RAF types. No.76 MU reported daily to the Air Ministry and the Admiralty so the allocation of shipping space could be kept up-to-date. In 1945 the RAF packed 477 aircraft for naval service overseas, of which one-third was dispatched to Sydney between March - June.¹⁴ However, the RAF was only responsible for British aircraft and by 1945 the majority of the BPF's aircraft were American.¹⁵ The British Aviation Supply Depot in Philadelphia, operational since August 1942, organised the delivery of 923 aircraft to the RN during 1945. Among these were 220 Avengers, 230 Corsairs and 316 Hellcats, many destined for Pacific operations where they spearheaded the British effort.¹⁶

The Packing and Shipping Programme of 19 June 1945, reveals the full complexity of the schedule.¹⁷ Between March - June, ninety-nine packed aircraft left Britain for Sydney aboard fourteen merchant vessels, while during May - June six ships with sixty aircraft departed the USA for the same destination. Sailing time from the UK to Sydney was three months. In addition HMS *Begum* sailed from the UK on 20 April with fifty-six erected aircraft. During June HMS *Vindex* carrying sixty planes was to follow from the UK with the *Empire Lagan* leaving the USA with forty-two Corsairs and Avengers at around the same time. Reinforcements in the shape of thirty-seven American and six British aircraft also were due to leave the Eastern Fleet aboard HMS *Activity* at the end of June. In the

¹² For details of dispatch of aircraft abroad see; An Analysis of the Packing and Shipping of Naval Aircraft throughout the war, 1939-1945, ADM 1/17528.

¹³ For details of 76 MU's role see Ibid.

¹⁴ Ibid.

¹⁵ At the beginning of 'Iceberg' the 1st ACS had 167 American aircraft (65 Avengers, 73 Corsairs & 29 Hellcats) and only 51 British aircraft (9 Fireflies, 40 Seafires & 2 Walrus).

¹⁶ History of Naval Store Department in North America, Appendix, Aircraft delivered to the Royal Navy, ADM 116/5813.

¹⁷ Appendix I (RN Packing and Shipping Programme including August 1945 consignments), 19 Jun 1945, ADM 1/17528.

same period the dispatch of aircraft engines to Sydney was as follows; thirteen from the UK, twenty-six from the USA and forty-one from the Eastern Fleet.¹⁸

Therefore in four months it was planned to dispatch ninety-nine packed and 116 erected aircraft from Britain with a further sixty packed and forty-two erected aircraft from the USA and forty-three erected planes from the East Indies station. The rate of ninety aircraft per month would have risen markedly if the BPF had operated two carrier groups in the autumn of 1945; in January, 1944, it was estimated that by the summer of 1945 the number of aircraft despatched from the UK and the USA to Sydney would increase from 180 to 300 per month.¹⁹

The delivery of air stores followed a similar pattern with thirty-two merchant ships delivering 6,870 tons of air stores to Sydney from 5 November 1944 until the end of April 1945. The biggest single delivery of 1400 tons arrived on *Port Alma* from America on 18 April. To put this quantity in context, before the ship's arrival there was a deficiency in Sydney of 40,000 air store items.²⁰ By 14 May, 3,000 tons of air stores had left Britain but a further 1,400 was awaiting shipment. The main delay was caused by a five week gap between the allocation of a shipment and the vessel sailing. This was a major improvement over the situation on 9 December 1944 when only sixty-three out of 600 tons was enroute.²¹

Only six ships carrying 724 tons of air stores arrived in Sydney before the 1st ACS on 10 February 1945, and almost no stores were ready for allocation: 'Indeed for all practical purposes, we may say that Air Stores were non-existent when the Fleet arrived.'²² The carriers had been ordered to stock up on spares from the five Royal Naval Air Stations in Ceylon before departure in mid-January and their position on reaching Australia was believed to be thus: '...the fleet carriers were considered to be stored with aircraft equipment and spares for six months, and it was thought that they would not call Sydney depot for stock replenishment until 31st May, 1945.'²³ But due to inadequate stocks at Ceylon on arrival in Sydney the Fleet made extensive calls for spares and despite the help of the Royal Australian Air Force and stocks from the Air Store Issuing Ship (ASIS) *Fort Colville* only ten per cent of the 2,300 items requested were procured.²⁴ It was not until July 1945, that sufficient air stores to cover most needs were in Australia and then the lack of

¹⁸ Ibid.

¹⁹ Memorandum on Naval Auxiliaries required to support the British Fleet in the Indian and Pacific Oceans, Annex F (Pacific Ocean), by Head of Military Branch II, Jan 1944, ADM 1/16287.

²⁰ Report on Pacific Air Store Requirements by Assistant Director of Stores, 1 May 1945, ADM 116/5806.

²¹ Notes of meeting held by the Director of Stores, 14 May 1945, ADM 116/5806.

²² Ibid.

²³ Part I (General Review), Section VI (Logistic Support for the Naval Air Arm of the British Pacific Fleet), ADM 199/119.

²⁴ Ibid.

personnel for administration and distribution was a hindrance. As will be seen later, lack of air stores was a major problem for forward units.

Facilities in Australia and the forward area

Based in Sydney was Rear Admiral Portal, Flag Officer Naval Air Stations, Australia, FONAS (A)²⁵ responsible to Vice Admiral Daniel²⁶ for the supply of aircraft and stores to the forward areas and the maintenance and repair of aircraft beyond the capacity of the FMAGs.²⁷

Aircraft facilities in Australia were divided between the three major erection and repair units and the four maintenance units. Newly arrived aircraft were despatched to the two Receipt and Dispatch Unit's (RDU's), MONABs II and VII, plus Transportable Aircraft Maintenance Yard I (TAMY I) where they were assembled, serviced and tested.

The planned capacity of MONAB II on arrival at Bankstown, near Sydney in January 1945 was 100 aircraft per month. The first two loads of aircraft to reach Australia arrived at Bankstown during January aboard CVE's *Fencer* and *Striker*. In February despite inadequate numbers of officers and men and much inexperience in addition to the fact that the airfield wasn't finished, ninety aircraft were completed – a fine achievement. About 100 aircraft per month were erected at Bankstown until the end of the war. The *ad hoc* nature of the logistic system was highlighted by the: '...sporadic and uncertain...' ²⁸ deliveries of aircraft to Australia which left the production lines at MONAB II idle at certain times and overrun at others.

TAMY I was the FAA's main repair installation based around Archerfield, Brisbane's civilian airport, from late March 1945. It conducted major and minor aircraft inspections, aircraft erections, engine overhauls and the dismantling of aircraft for spares in a process called 'reduce to produce' which involved over 100 men and dealt with fifteen planes per month. Rear-Admiral Portal praised this vital effort: 'Because of the shortage of spares which persisted throughout, this work was of the utmost importance.'²⁹ The erecting capacity of TAMY I was relatively minor compared with MONAB II, at between twenty-five and thirty per month.³⁰ None of the 150 engine overhauls begun at TAMY I were completed by August 1945, due to the lack of spares although the potential output was 100

²⁵ Rear Admiral Portal was titled Flag Officer Naval Air Pacific (FONAP) from June 1945.

²⁶ Vice Admiral Daniel, VA (Q), commanded the entire logistic effort from his headquarters in Melbourne on behalf of Admiral Fraser.

²⁷ Unpublished notes on Staff History of British Naval Aviation, 1919-1945, Volume 3, 598, NHB.

²⁸ Part III (Air Engineering), Section I (Erection of aircraft), ADM 199/119.

²⁹ Ibid.

engines per month. The extent of aircraft wastage was such that aircraft were often ditched rather than repaired and the few engine overhauls required were tackled by the repair ships.³¹

MONAB VII, the second RDU, was established on the site of TAMY I in July 1945, and the requirement for this combined base was 125 erected aircraft per month, but the total in the month before the end of hostilities was only forty-six. The improvised nature of the base was the major obstacle: 'It is considered most improbable that MONAB 7, equipped with portable hangars, and supported only by an M.M. [Mobile Maintenance] component would ever have produced a satisfactory output of erected aircraft, from a forward airfield.'³² An all weather airfield with permanent hangars and full equipment was deemed necessary.

Between 1 March - 15 August 1945, an estimated 730 aircraft were brought into service, a figure never contemplated before the start of operations. The average effort in man-hours to make an aircraft serviceable was 2000 hours for a packed Firefly, 1800 for an erected Avenger, or 1000 for a partly erected Hellcat.³³ Erected aircraft were often found to be a poorer condition than their packed compatriots but the most pressing shortages, as in all aspects of air logistics, were in spares and tools.

Maintenance support to squadrons while ashore in Australia was provided by MONAB's I, III, V and VI. MONAB's I and III were standard units comprising one Mobile Maintenance Component (MM) and two Mobile Servicing Components (MS). The MM was the larger and better equipped, capable of repairing or replacing aircraft components in its workshops and hangars. The MS was a small mobile unit capable of offering assistance in light maintenance to a squadron after it flew ashore, equivalent to the Squadron Servicing Units established in Britain, and each was equipped for one aircraft type. Those in MONAB I for Avengers and Corsairs and in MONAB II for Fireflies and Seafires. Both were in place just in time to accept aircraft from the Fleet Carriers in February 1945. When plans to establish an air base in the Philippines were abandoned in June 1945, MONAB's V and VI were also based in Australia.

Forward air bases were located on the small coral islands of Ponam and Pityliu off Manus in the Admiralty Islands, formerly used by the Americans. MONAB IV on Ponam comprised the usual MM and MS components plus a Mobile, Servicing and Repair unit –

³⁰ Part IX (MONAB's - Reports of Proceedings), Section 8 (R.N. TAMY I – Report of Proceedings). ADM 199/119.

³¹ Part III (Air Engineering), Section 2 (Repair Policy), ADM 199/119.

³² Part I (General Review), Section 3 (Air Engineering). ADM 199/119.

³³ Ibid.

MSR 4 – to maintain an aircraft reserve forward of Australia. MSR's were equipped, in theory at least, for all aircraft types. Personnel and equipment for MONAB IV arrived with the remainder of the Fleet Train in early March. Further units – MSR's 1 and 6 – arrived in June to build up a Forward Aircraft Pool (FAP) comprising '...40% of the embarked F.A.E. [First Line Aircraft Establishment].'³⁴ The quantities of aircraft passing through MONAB IV were as follows:³⁵

	Received	Despatched
May	40	0
June	72	44
July	6	53
August	48	28

MONAB IV reported a high rate of unserviceability among arriving aircraft and HMS *Unicorn*, the aircraft repair and maintenance ship, called in on her way to Sydney at the end of May to examine the situation and land a number of Seafires requiring test flights.³⁶ Since Manus had been an American base and a party of Americans remained to maintain the coral air strips, it was unlike any other MONAB in the Pacific: 'Because of the semi-permanence of the facilities here, [HMS] *Nabaron* [MONAB IV] has become less and less a Mobile Air Base and more and more a Naval Air Station.'³⁷ Without the considerable assistance of the US Navy it is difficult to see how MONAB IV could have operated effectively.

Additional forward support was provided by the Air Train, as support afloat was known from June. Initially Commodore Mereweather aboard *Unicorn* co-ordinated air logistics in the forward area for Rear-Admiral Portal, with Commodore Murray-Smith of HMS *Pioneer* taking over in June. First to arrive were *Unicorn*, and ASIS *Fort Colville*, with the rest of the Fleet Train at Sydney in February. They sailed onto Manus in early March. HMS *Deer Sound*, an Aircraft Component Repair Ship, reached Manus on 9 April when 'Iceberg One' was underway. Further reinforcements in the shape of HMS *Pioneer*, an Aircraft Maintenance Ship, and a second ASIS *Fort Langley* took part in the July/August operations which improved the situation considerably: 'The general spares position was helped by the arrival of ASIS *Fort Langley* in the forward area...stored for all

³⁴ Ibid.

³⁵ Part IX (MONAB's - Reports of Proceedings), Section 4 (MONAB No 4 – Report of Proceedings), ADM 199/119

³⁶ Report from CO, HMS *Unicorn*, to Rear Admiral Fleet Train, BPF, Appendix I (Diary – H.M.S. Striker), 31 May 1945, ADM 199/1745.

³⁷ Ibid.

five first line types.’³⁸ *Pioneer*, a converted Light Fleet Carrier, also proved a valuable addition.

The Director of Plans, Quartermaster Branch, submitted a report in August 1945 reviewing the progress of the three Fleet Air Maintenance Groups planned in January 1944.³⁹ Allocated to each group was an Aircraft Maintenance Ship, an Aircraft Component Repair Ship and an Aircraft Engine Repair Ship. Only the first group was anywhere near operational with *Pioneer* and *Deer Sound* on station and Aircraft Engine Repair Ship *Beaulieu Firth* to join shortly. Vessels in the second group were not due until October 1945 and work on the remainder was suspended. This illustrates the lengthy processes of construction and conversion: after eighteen months planning, only one-third of the ships were available.

It is worth discussing here the contrasting fortunes of two Air Train ships. Among the delays and shortages afflicting the air stores organisation, a notable success was the arrival of ASIS *Fort Langley* at Manus in June 1945, loaded with stores for all the types of aircraft. Since the autumn of 1944 the supply of air stores from the USA for British use had been directed primarily towards the Pacific, rather than Britain or Ceylon. *Fort Langley* was stored at Victoria, British Columbia, most of the stores having been shipped 3,000 miles from the British Naval Store Depot in Philadelphia. Stores also arrived from the UK and missing items were scrounged from Air Store Depots along the west coast. The ship sailed with ninety-eight per cent of stores embarked, a figure that compares very favourably with ships sailing from the UK. The main difficulty was the late arrival of British stores from the UK causing some stores to remain unpacked and unstowed when she sailed.⁴⁰

An entirely opposite experience accompanied the passage of Aircraft Component Repair Ship *Deer Sound* which arrived in Sydney on 23 February. She was stored with only seventy-seven per cent of items before leaving the UK, being 4,500 items short of the full complement of 18,250.⁴¹ Captain Johnson complained that in the initial six weeks of storing in the UK, in addition to general air stores, the only specific spares received were for Seafire’s airframes plus Seafire and Firefly propellers. Many deficiencies were met when the ship arrived at Greenock on 4 January 1945, but when she sailed for the Far East four days later she was still 2000 items short and carrying a number of repairable components, but without repair equipment. More repairable spares, tools and equipment

³⁸ Ibid.

³⁹ Report by Director of Plans, Quartermaster Branch, 23 August 1945, ADM 1/19015.

⁴⁰ History of Naval Store Department in North America, Section 3 (Air Stores and Equipment), Chapter XLV (Air Stores and Equipment – Outfitting of Ships in U.S.A), ADM 116/5813.

⁴¹ Report from Admiralty to Vice Admiral (Administration), BPF, 31 April 1945, ADM. 199/1759.

were loaded at Colombo. However, in Sydney, *Deer Sound* received signals ordering that she should be stowed with sufficient stores to maintain 250 aircraft for six months. Accordingly she placed an order for another 15,000 items! Unsurprisingly few of these could be obtained as the air stores situation was stretched to breaking point by demands from the 1st ACS. On leaving Sydney, her captain estimated that the ship had a full complement of equipment and tools but only twenty per cent of essential stores now deemed necessary to carry out her task.⁴² The assessment by Captain Merewether of *Unicorn* on *Deer Sound*'s situation was devastating:

‘It might repay an investigation to find out why this ship was sent from England to the forward area via Sydney only to arrive in such a condition... She is lacking in repair material; hydraulic seals, rivets, but, on arrival at Sydney, she carried arrester hooks, aerofoils, cockpit covers, complete wireless sets and other material, which were of no use to her but were possibly needed elsewhere...in effect she proved a drain on the fleet. In these circumstances *Deer Sound* is being returned to the main base, and it is proposed that she remains there until fully stored – however long that may be.’⁴³

Most logistic units arriving in Australia, whether MONAB's, support afloat or CVE's made initial requests for spares, but none on the scale of *Deer Sound*.

Air logistics during Operation ‘Iceberg’, 26 March - 25 May 1945

While the four carriers of the 1st ACS swayed at their anchors at Manus between 8 - 22 March in preparation for ‘Iceberg’, the replenishment CVE's supplied thirty-two aircraft including eight repaired and modified by *Unicorn*.⁴⁴ *Unicorn* was the lynchpin of the supply chain for Operation ‘Iceberg’ anchored in San Pedro Bay, Leyte in the Philippines, several hundred miles forward of Manus. The ship had arrived at Sydney from Colombo on 12 February loaded with eighty-two aircraft and 120 engines. After an exchange of aircraft with MONAB II at Bankstown, she headed for Manus and then Leyte for the beginning of ‘Iceberg One’ on 25 March. Replenishment CVE's shuttled from *Unicorn* the 700 miles to and from the Fleet. Her role was severely criticised by Rear-Admiral Vian on 14 May: ‘HMS *Unicorn* in her present capacity is of very little use, if fleet carriers were to accumulate wrecks on board for transfer to a repair carrier once a month, the CV's

⁴² Report from CO, HMS *Deer Sound* to Rear Admiral Fleet Train, BPF, 22 Mar 1945, ADM 199/1759.

⁴³ Report from CO, HMS *Unicorn* to Rear Admiral Fleet Train, BPF, 4 May 1945, ADM 199/1759.

⁴⁴ Report from CO, HMS *Unicorn*, to Rear Admiral Fleet Train, BPF, 2 May 1945, ADM 199/1745.

operational value would become more and more negligible as the month ran out its course.’⁴⁵ There was simply no alternative to the use of *Unicorn* in this forward role because there was no airfield available at Leyte. Without her presence at Leyte the CVE’s would have to travel from Manus, twice the distance, and there were not enough available in March 1945 to carry out that task. *Unicorn*’s time at Leyte would have been more successful if an airfield had been available as this would have enabled more test flying of aircraft to be carried out. However, between 19 March - 27 May, *Unicorn* repaired or modified seventy-two aircraft of which seventy were supplied to the fleet.⁴⁶ The supply of aircraft to *Unicorn* during ‘Iceberg’ was maintained by ferry CVE’s from Manus. *Fencer* arrived at Leyte on 11 April, *Ruler* on 27 April and *Chaser* on 11 May.

The replenishment CVE’s of the 30th Aircraft Carrier Squadron (AC30), commanded by Commodore Carne, provided the final link in the logistic chain transporting aircraft from Leyte to the 1st ACS in replenishment area off the Sakishima Gunto. The Operational Schedule of February 1945 clarified the initial availability of CVE’s: ‘At the start of the operation there will be 4 CVE’s available for Ferry and Replenishment duty:- Striker, Fencer (Ferry only), Speaker, Slinger...’⁴⁷

Even at the beginning of March, as Carne commented, ‘...the problems which were to arise were quite unforeseen and with the future employment of the British Pacific Fleet still undecided, no air replenishment planning had or could be undertaken.’⁴⁸ *Striker* left Manus on 19 March to rendezvous with the carriers, transferring four aircraft to replace those lost since the fleet departed Manus. The second replenishment carrier *Slinger* headed for Leyte with *Unicorn* and *Fort Colville*. A third CVE, *Speaker*, accompanying *Striker*, supplied Combat Air Patrols (CAP) and anti-submarine (A/S) cover for the Fleet Train in the forward area and the whole BPF during replenishment periods. The logistic plan in the forward area was detailed in the ‘History of the Fleet Train’: ‘...three or four Task Units were formed to ply between Leyte and the fuelling area, the distance being about 700 miles each way. A typical Task Unit would consist of three tankers, one escort carrier, and two or three escort vessels.’⁴⁹ According to the orders for Air Operations of Rear-Admiral Vian, commanding the 1st ACS, the ideal loading for a CVE was six Avengers, nine Corsairs,

⁴⁵ Report from Flag Officer Commanding, 1st ACS, BPF, to C-in-C, BPF, 14 May 1945, ADM 199/590.

⁴⁶ Figures compiled from Report from CO, HMS *Unicorn*, to Rear Admiral Fleet Train, BPF, 2 May 1945 and Report from CO, HMS *Unicorn*, to Rear Admiral Fleet Train, BPF, 31 May 1945, ADM 199/1745.

⁴⁷ British Operational Schedule in Operation ‘Iceberg’ from Evans Lombe to C-in-C, 13 Feb 1945, ADM 199/1745.

⁴⁸ Report from Commodore Commanding, AC30, to C-in-C, BPF, 4 Nov 1945, ADM 199/119.

⁴⁹ The History of the Fleet Train, British Pacific Fleet, November 1944 – August 1945, ADM 199/1766.

four Seafires, four Hellcats and one Firefly but admitted ‘It should not, however, be assumed that this loading will be achieved at any time.’⁵⁰

The CVE’s suffered two inherent handicaps, one related to their design and another which impacted on all aspects of the logistic chain. As American built vessels, they were equipped with American type catapults from which British aircraft could not be launched. With a maximum speed of only eleven knots, the full length of the flight deck was required to launch British aircraft in light wind conditions. All CVE’s carried a mix of British and American types. This reduced aircraft capacity, stored in the hangar only, to a maximum of twenty-five. By comparison, USS *Attu* delivered seventy-six aircraft to the USN’s carriers off Okinawa in one replenishment: the ability to catapult all aircraft being crucial, although the *Attu* class were also twin-screw ships capable of twenty knots.⁵¹ The second problem was providing replacements for five different types of aircraft for only four carriers! Coupled with the small complements of the CVE’s this meant that only a few of each type were carried, as illustrated by Vian’s ‘ideal loading’ orders above. Admiral Fraser was fully aware situation and the advantages of standardisation:

‘...the multiplicity of types is a grave hinderance in this type of warfare. It leads to tactical and logistic inflexibility and also is most uneconomical... the American aircraft (Avenger, Corsair and Hellcat) which are satisfactory are so altered to British requirements that any idea of pooling of resources with the Americans – even in this American product – would be impossible.’⁵²

The results of the replenishment periods during ‘Iceberg One’ were as follows:⁵³

Date	Carrier	Aircraft carried/supplied to the Fleet
28 March	<i>Striker</i>	14/13
4-5 April	<i>Slinger</i>	25/22
8 April	<i>Striker</i>	14/11* (12 launched – one crashed*)
	Total	57/46

There were no immediate reinforcements for the meagre forces at Leyte and Manus and with only two CVE’s: ‘...the supply of aircraft to the fleet from Leyte was very much on a

⁵⁰ Memorandum ‘Section II (Air Orders)’ from Flag Officer Commanding, 1st ACS, BPF, to The Flag and Commanding Officers, HM Ships, BPF, 22 March, 1945, ADM 199/1745.

⁵¹ Unpublished notes on Staff History of British Naval Aviation, 1919-1945, Volume 3, 579, NHB.

⁵² Despatches, Nov 1944 – Jul 1945, from C-in-C, BPF, to Admiralty, 23 Nov, 1945, ADM 199/118.

hand-to-mouth basis.’⁵⁴ When, in response to American requests, ‘Iceberg One’ was extended beyond 11 April, its original completion date, it was not possible to supply CVE’s for the replenishment periods of 14-15 and 18-19 April. By the end of ‘Iceberg One’ the 1st ACS had lost sixty-eight aircraft but had received only forty-four replacements.

Many elements of the CVE’s operations were of an extemporized nature, the remarks on aircraft supply by *Slinger*’s Commanding Officer on 7 April is just one example: ‘Who controls this? Presumably FONAS (A) sends up what he can. Does AC1 [Rear-Admiral Vian] state any special requirements to anyone? I was given no message to bring. Presumably I take what *Unicorn* offers and get on with it.’⁵⁵ Vian’s air orders, issued on 22 March, stated he would report as early as possible: ‘...the replacement requirements of each Fleet Carrier individually...’⁵⁶. Clearly it had not reached one of its most important recipients.

The most serious deficiency during ‘Iceberg One’ was apparent in air stores exemplified by the situation on 8 April when, as Captain Mereweather of *Unicorn* remarked, *Unicorn* and *Formidable* were required to supplement the exhausted stocks in *Fort Colville* to meet requests from the Fleet.⁵⁷ Before the start of ‘Iceberg Two’ the most urgently required stores had to be up flown from Sydney. Commander L.S. Davis, the Fleet Train Naval Store Officer, commented on the unprecedented expenditure of certain air stores during ‘Iceberg One’ and that the situation: ‘...was only overcome by the timely arrival of supplies from Sydney by air; assistance from the U.S. Navy; and the withdrawal of stocks from H.M. Ships *Unicorn* and *Illustrious* – that latter having been partly de-stored prior to leaving for refit.’⁵⁸ *Fort Colville* returned to Sydney on 3 May to re-store, transferring some stores to *Unicorn* before her departure. *Unicorn* supplied 204 separate patterns of air stores to the carriers throughout ‘Iceberg’.⁵⁹

During the break at San Pedro Bay, Leyte, from 23 April - 1 May, a further 39 aircraft were transferred by the replenishment CVE’s. For ‘Iceberg Two’, *Speaker*, *Striker* and the newly arrived *Chaser* were each present for two replenishment periods. *Slinger* had

⁵³ Report of Proceedings from Commodore Commanding, AC30, to Rear Admiral Fleet Train, BPF, 29 April 1945, Appendix I (Diary of Events), ADM 199/1745.

⁵⁴ Report ‘Experience gained by 30th Aircraft Carrier Squadron in the British Pacific Fleet’ from Commodore Commanding, 30th Aircraft Carrier Squadron to C-in-C BPF, 4 Nov 1945, ADM 119/199.

⁵⁵ ‘Some remarks on replenishment’ from CO, HMS *Slinger*, 7 April 1945, ADM 199/1759.

⁵⁶ Memorandum ‘Section II (Air Orders)’ from Flag Officer Commanding, 1st ACS, BPF, to The Flag and Commanding Officers, H.M. Ships, British Pacific Fleet, 22 Mar, 1945, ADM 199/1745.

⁵⁷ Report from CO, HMS *Unicorn*, to Rear Admiral Fleet Train, BPF, 2 May 1945, ADM 199/1745.

⁵⁸ Report of Proceedings up to 31 May 1945, from Rear Admiral Fleet Train, BPF to C-in-C, BPF, 7 Jun 1945, Appendix E (Report by Fleet Train Naval Store Officer), ADM 199/1766.

⁵⁹ Report from CO, HMS *Unicorn*, to Rear Admiral Fleet Train, BPF, 31 May 1945, ADM 199/1745.

suffered an engine failure on a trip to Manus. *Ruler* replaced *Speaker* in the CAP and A/S role.

The aircraft situation in the central Pacific on 1 May 1945 was thus; Fleet Carriers 230, *Striker* twenty-four, *Speaker* twenty-five, twenty-six in reserve aboard *Unicorn* plus twenty-two for CAP duties on *Ruler*. A further twenty-four aircraft awaited repair on *Unicorn*, seven were at Ponam, thirty-three were being ferried to the forward area by *Chaser* and eleven awaited transfer to Ponam from *Illustrious* which was returning to the UK for refit.⁶⁰ The replenishment schedule for 'Iceberg Two' which commenced on 4 May was:⁶¹

Date	Carrier	Aircraft carried/supplied to the Fleet
6 May	<i>Striker</i>	23/15
10-11 May	<i>Speaker</i>	25/17
14-15 May	<i>Striker</i>	24/20
18-19 May	<i>Chaser</i>	22/8
22-23 May	<i>Chaser</i>	/13* (4 to <i>Ruler</i> , the CAP carrier *)
22-23 May	<i>Speaker</i>	24/14
Total		118/87 ⁶²

Aircraft losses in May were 135, but there was no supply failure. A serious hangar fire aboard *Formidable* on 18 May damaged thirty aircraft, after which the carrier was despatched to Sydney for a refit. The aircraft lost during the final strike period of 24-25 May also did not require replacing.

Striker's diary for May, 1945, illustrates a CVE's typical replenishment programme.⁶³ She sailed from Leyte on the morning of 3 May in the company of *Ruler*, two tankers and four destroyers, arriving in the servicing area on the afternoon of 5 May. The support ships rendezvoused with the fleet the following day and *Striker* flew off fifteen aircraft and received thirty-four casualties from *Formidable* before immediately

⁶⁰ For figures see Ibid.

⁶¹ Figures compiled from: Report from CO, HMS Unicorn, to Rear Admiral Fleet Train, BPF, 31 May 1945; Report of Proceedings from Commodore Commanding, AC30 to Rear Admiral, BPF, 29 Apr 1945, Appendix I (Diary of HMS Striker); Report of Proceedings from CO, HMS Striker, to Commodore Commanding, AC30, 7 Jun 1945; Report of Proceedings from CO, HMS Chaser, to Commodore Commanding, AC30, 17 Jun 1945, ADM 199/1745.

⁶² A figure of 78 is quoted in Report by C-in-C, BPF, 6 Nov 1945; enclosure, report No. FORO 9 by Fleet Operational Research Officer, 15 Oct 1945, ADM 199/118.

The figure of 87 has been used since the Report of Commanding Officer, H.M.S. Unicorn, 31 May, 1945. provides a breakdown of the total and these agree with all available reports of Commanding Officer of the replenishment CVE's.

⁶³ Report from CO, HMS Unicorn, to Rear Admiral Fleet Train, BPF, 31 May 1945, ADM 199/1745.

sailing for Leyte escorted by the destroyer *Kempfenfelt*. From 1900hrs on 8 May until the morning of 12 May, *Striker* was based at Leyte's San Pedro Bay. When she left on 12 May accompanied by two tankers and two destroyers, twenty-four replacement aircraft were on board. *Striker's* second replenishment period began on 14 May which saw fourteen aircraft despatched and one flyable dud received. The next day a further six replacements were sent over and another flyable dud arrived. This marked the end of *Striker's* participation in 'Iceberg'. The ship returning to Leyte on 17 May and from 18-28 May was escorted back to Sydney by the destroyer *Ulster*.

Chaser was one of the other two CVE's providing replacement aircraft for 'Iceberg Two'. Her narrative for the final replenishment period of 22-23 May illustrates a CVE's varied programme:⁶⁴

22 May

- 0850 - Embarked pilots from *Undaunted*
- 0950 - Flew off five Corsair IV's to *Victorious*
- 0955 - Landed on one Corsair IV and three Avenger II's 'Flyable duds' from
Victorious
- 1600 - Transferred pilots to and from *Undaunted*
- 1655 - Flew off three Hellcat I's to *Ruler* and one Hellcat II to *Indomitable*
- 1720 - Flew off one Hellcat II to *Ruler*
- 1754 - Embarked mail and correspondence from *Napier*

23 May

- 0652 - Flew off three Corsair II's to *Victorious*
- 0701 - Flew off one Corsair II to *Victorious*
- 1038 - Embarked hospital cases from *Quadrant*
- 1120 - Transferred mail and correspondence from *Quality*
- 1145 - Transferred mail from *Wessex*
- 1255 - Embarked 1 Officer and 92 Ratings (ex *Quilliam*) from *Black Prince*
- 1745 - Transferred correspondence from *Napier*
- 1755 - Embarked personnel and mail from *Quadrant*
- 1815 - Formed T.U. 122.1.10 with *Napier* and *Speaker* and sailed for Manus

Like most CVE's, *Chaser* found keeping aircraft serviceable most problematical. Spares for American aircraft were lacking and they had to be sourced from flyable duds or even

the Fleet Carriers. The maintenance complement, largely comprised of MSR 5A, only joined the ship at Manus and was unused to being afloat, in addition to being unfamiliar with some of the types of aircraft and engines embarked.⁶⁵ Commodore Carne complained that the CVE's were severely under prepared for their task:

'...they had nothing like an adequate complement of air maintenance ratings and numbers had to be made up by drafting of air sections of MSR's most of whose ratings had never been at sea. All ships had a most limited range of air stores and yet had to maintain operational aircraft for far longer periods than had been expected.'⁶⁶

The capabilities of *Slinger* and *Speaker* were certainly affected as their operational squadrons were despatched to Fleet Carriers to provide additional aircraft and aircrew. At the conclusion of 'Iceberg One', *Speaker* was ordered to transfer all 1840 Squadron pilots to *Indomitable* in addition to seventy maintenance ratings leaving only 100 of the latter on board. The change from an operational carrier with a Hellcat Squadron to replenishment carrier for all types of aircraft, left *Speaker* with only spares for and maintenance ratings familiar with this single type of aircraft. Ratings embarked from MSR 5 brought experience of other aircraft, but additional spares never arrived. In the light of these experiences the comments of Captain Denny of *Victorious* are hardly surprising: 'Considerable work has to be done on replacement aircraft before using them on operations, and the aircrews in consequence inclined to mistrust these aircraft.'⁶⁷ Carne was left in no doubt that both front line carriers and replenishment CVE's should be regarded on a similar level – that of a fully operational carrier:

'...to carry out her main function the replenishment CVE must be an efficient aircraft carrier. The replenishment CVE has to achieve efficient maintenance of all types of operational aircraft and to carry out flying operations to meet the ever rapidly changing circumstances in the fuelling area... she must have a properly worked up ship's company...left as undisturbed by drafting as a fleet carrier.'⁶⁸

⁶⁴ Report of Proceedings from CO, HMS Chaser, to Commodore Commanding, AC30, 17 Jun 1945, ADM 199/1745.

⁶⁵ Report of Proceedings from CO, HMS Chaser, to Rear Admiral Fleet Train, BPF, 17 Jun 1945, ADM 199/1745.

⁶⁶ Report from CO, AC30 to Rear Admiral Fleet Train, BPF, 23 Jun 1945, ADM 199/1745.

⁶⁷ Report from CO, HMS Victorious, to Flag Officer Commanding, 1st ACS, BPF, 14 Apr 1945, ADM 199/595.

Unfortunately sufficient resources were not available in the Pacific for this situation to be realised. Throughout 'Iceberg' the aircraft replenishment programme was precarious, if the allocated carrier had broken down, no substitutes were available.

Air logistics during the July/August operations, 17 July - 10 August 1945

The arrangements for the July/August operations involved substantial changes to the 'Iceberg' plan. Leyte was abandoned as a forward base since no airfield had been obtained ashore. All ships of the Air Train, *Unicorn*, *Pioneer*, *Deer Sound*, *Fort Colville* and *Fort Langley*, were based at Manus where they could operate in conjunction with the units ashore there. *Arbiter*, *Chaser*, *Speaker* and *Striker* were available for replenishment duties, with *Ruler* continuing in the CAP role. The 'History of the Fleet Train' recorded the new despatch arrangements:

'Unlike 'Iceberg' they [CVE's] did not work to a regular timetable, one meeting the Fleet on each occasion of re-fuelling... two were sent forward at the beginning and the others at weekly intervals. They were retained as long as any aircraft remained for issue and sent back empty for reloading and return.'⁶⁹

Arbiter made two trips and *Chaser*, *Speaker* and *Striker* one each. Since they sailed from Manus, rather than Leyte, their 700 mile trip during 'Iceberg' was increased to nearer 2500, the equivalent of Clyde to Montreal or Portsmouth to Tobruk. It took nine days, rather than two, to travel from the forward base to replenishment area. At the last replenishment period of the Pacific war on 10 August with a reduced fleet and only one fleet carrier, *Indefatigable*, *Ruler* was the only CVE present. The pattern for aircraft supply during July/August was as follows:⁷⁰

Date	Carrier	Aircraft carried/supplied to the Fleet
20-21 July	<i>Striker</i>	22/24
	<i>Arbiter</i>	24
26-27 July	<i>Arbiter</i>	/29
	<i>Speaker</i>	24

⁶⁸ Report from CO, AC30 to Rear Admiral Fleet Train, BPF, 23 Jun 1945, ADM 199/1745.

⁶⁹ The History of the Fleet Train, BPF, November 1944 - August 1945, ADM 199/1766.

⁷⁰ Report by Commander-in-Chief, BPF, 6 Nov 1945; enclosure, report No. FORO 9 by Fleet Operational Research Officer, 15 Oct 1945, ADM 199/118,

31 July –	<i>Speaker</i>	/27
2 August	<i>Chaser</i>	19
6-7 August	<i>Arbiter</i>	27/22
Total		116/102

While ninety-nine replacement aircraft were requested by the Fleet and 102 were despatched by the CVE's, supplies were not always available at the right time as the Operational Research Report acknowledged: ‘...had there been a strike period between August 2nd and August 6th, a serious deficiency in the availability of aircraft might have arisen...two more ferry carriers, at least, would have been necessary, to ensure that all requirements were comfortably met on time...’⁷¹

During 31 July - 2 August, thirty-seven replacements were requested but *Chaser* and *Speaker* could supply only twenty-seven.⁷² Of the fifteen Corsairs, eleven Seafires and four Fireflies required, only ten, six and three respectively were available. *Chaser*, the newly arrived ship, had nineteen aircraft aboard of which eight were Seafires, four Corsairs and three Seafires, however she was expected to be available for next replenishment period as well. By contrast she had four Hellcats which were not requested although one was supplied anyway.⁷³ As the Fleet did not mount any operations before the next scheduled replenishment on 6 August, owing to a typhoon, the shortcomings were rectified by *Arbiter* which flew over a further twenty-two aircraft on 6-7 August. The CAP carrier, *Ruler*, supplied several Corsairs when the stocks were inadequate; thirty-five Corsairs were requested by the Fleet in the first three replenishment periods and thirty were duly received, but records indicate the four replenishment CVE's carried only twenty-three.⁷⁴

Rear-Admiral Denny of *Victorious* remained less than complimentary about his ship's new aircraft: ‘The great majority of such aircraft flown on board are NOT operationally fit and cannot be flown in the next day's strikes.’⁷⁵ Vice-Admiral Vian, however, claimed that air logistics were improving: ‘This situation is, however, being steadily rectified, though much remains to be done... Aircraft coming forward are in a better state than during ‘Iceberg’.’⁷⁶

⁷¹ Ibid.

⁷² Ibid.

⁷³ Ibid.

⁷⁴ Ibid.

⁷⁵ Report from CO, HMS *Victorious*, to Flag Officer Commanding, 1st ACS, BPF, 14 Aug 1945, ADM 199/1478.

⁷⁶ Report from Flag Officer Commanding, 1st ACS, BPF, Enclosure No.2 (Remarks on Air Operations), to Vice Admiral, Second-in-Command, BPF, 23 Aug 1945, ADM 199/1478.

Conclusion

The achievement of the BPF's air logistics organisation was very much against the odds enabling the 1st ACS to complete the most ambitious air operations which the Royal Navy had ever attempted. The delayed decision to deploy a Pacific fleet meant the first MONAB's did not arrive in Australia until January and no CVE's were nominated until February. Initially units lacked the spares and equipment to do their job. During 'Iceberg', there were few reinforcements available, spares were in short supply and many aircraft supplied had been assembled hurriedly with insufficient inspection and test flying. The reasonably settled base at Manus for July/August operations produced a much smoother running organisation although the CVE's had to travel 800 miles further than their US counterparts from Ulithi. Ultimately most of the aircraft and stores were coming from the UK or USA, the former three months from Australia, so only time would solve the problems. Admiral Fraser noted the serious difficulties caused by the failure of air stores supply: '...the lack of air stores came nearer to causing a complete breakdown in operations than any other single factor... Air store troubles have been endemic on all foreign stations throughout the war...' ⁷⁷

Nevertheless, the 235 aircraft supplied represented sixty per cent of the 344 lost by the 1st ACS. Unpredictable losses such as those inflicted by Kamikazes or hangar fire accounted for thirty per cent of the losses, so the logistic plan was sufficient to provide for purely predictable, operational losses, but there was no margin for unforeseen events. The US carriers would also have run short of aircraft during 'Iceberg', but several suffered Kamikaze hits and withdrew, transferring their aircraft to other vessels. ⁷⁸ The logistic units of the FAA had demonstrated their ability to maintain in the demanding naval environment which hitherto had been the sole preserve of the United States Navy.

Thesis summary

This thesis provides an original interpretation of naval aviation, not only by approaching the topic from a logistic rather than an operational viewpoint, but also by affording the development of the Royal Naval Air Service the prominence it deserves within this context. In many ways the study of the RNAS is the more fascinating because of the novelty of aviation. The use of the Imperial War Museum's Sound Archive has provided a fascinating insight into the backgrounds and training of maintenance personnel during the

⁷⁷ Report from C-in-C, BPF, to Secretary of Admiralty, Part II (Analysis), Section II, (Logistic Lessons), d (Air Stores), 15 Mar 1945, ADM 199/118.

⁷⁸ Unpublished notes on Staff History of British Naval Aviation, 1919-1945, Volume 3, 580-581, NHB.

First World War which is not available from the official records. The fact that the navy saw itself as most certainly the Senior Service in this period and acted accordingly in relation to procurement and operations undoubtedly soured relations with the RFC and did little to endear it to the Cabinet. The priority afforded to maritime operations in 1916 seems to have been rather less than that given to a bombing offensive in conjunction with the French.

This study places the role of naval air stations and other shore facilities in a much more prominent light than hitherto. Their importance is perhaps most vividly illustrated by developments overseas culminating in the Pacific operations, but neither should their indispensable role in training and accommodation of squadrons in Britain be overlooked. For most of the Second World War squadrons spent a considerably greater time ashore than afloat. In addition since the construction of new air stations was a lengthy process, the lack of such facilities posed a significant barrier to FAA expansion. The cost of RNAS facilities highlights the relative complexity of those for flying boats and airships, which is also reflected in the cost of the machines themselves, in relation to aeroplanes which could be operated from rudimentary facilities.

The folly of the dual control arrangement during the inter-war years has been demonstrated, not just in terms of aircraft procurement which other authors have also emphasised, but the impact which this had on the provision of shore facilities to meet the requirements of the expansion programmes and the lack of a maintenance organisation which forced a substantial reliance on RAF resources in both cases. At various times the Admiralty considered the possibility of taking on the training of all FAA maintenance personnel at naval establishments, but the pressures of wartime made this impossible.

The thriving relationship between the Admiralty and British manufacturers during the First World War can be contrasted with the increasingly difficult liaison which existed twenty years later. That is not to say that aircraft production for the RNAS was hugely successful in meeting production targets which was hampered by the availability of engines and the building of complex machines such as flying boats, but the navy was equipped with some of the finest aircraft types of the period. The sorry state of aircraft production in the 1930s could not be easily rectified in wartime, both on account of the Admiralty's limited air engineering expertise, the limited production facilities afforded to it by the Ministry of Aircraft Production and the incompetence of some of its major manufacturers. The importance of foreign aircraft production to the success of naval operations is most obvious from the enormous American contribution in World War II, however the French also provided crucial supplies in 1914-1916.

Above all the one major lesson is the difficulty of co-ordinating all the various logistic elements to bring air expansion programmes to fruition. Not only do the carriers have to be built, air stations commissioned and aircraft procured, but adequate numbers of maintenance personnel also need to be trained. Delays in carrier construction can lead to their squadrons being underemployed with a subsequent effect on morale. A lack of air stations can result in the formation of squadrons being deferred. If it becomes necessary to break up existing units to provide experienced personnel for new squadrons then front line forces would be hit. Without suitable aircraft the ability to carry out certain operations will be restricted. Even if all the other aspects are in place the lack of comparatively mundane air stores could and did have a serious impact on operational effectiveness. Yet the problems of planning in wartime meant that changes to policy were frequently necessary be it the reduction of the forecast number of flying boats in 1917-1918 to take account of more realistic production schedules, or the need to deploy Escort Carriers to a new range of duties in World War Two. Given the perceived Admiralty opposition to operating shore-based squadrons in the Second World War it was interesting to read the debate which attended their proposed withdrawal in 1943. Even when considerable resources were available in 1945 a drastic change in the nature of operations, far more sustained and intensive than hitherto, resulted in the logistic chain being stretched to breaking point.

However, while logistic difficulties hampered the ability of naval aviation to undertake certain operations, logistics also proved to be a great enabler in the operational sphere. The rapid construction of non-rigid airships early in the First World War saw a major advance in anti-submarine capabilities. A combination of flying boats, airships and seaplanes operating from a large number of bases facilitated a highly impressive anti-submarine effort from 1917. The swift redeployment of aircraft from Luxeuil to the Western Front in 1917, albeit against the Admiralty's better judgement, provided reinforcements for the RFC in a key period of the air war. The build up of a worldwide network of air stations and repair facilities in the Second World War may have been lengthy and problematic, but operationally it gave the FAA global reach on a scale that it could not have dreamt of in 1939. The fact that Katukurunda in Ceylon was the FAA's largest air station in 1944 is a clear demonstration of this. As has been stated a number of times in this thesis, the substantial quantities of American equipment supplied to the FAA and the training facilities made available in the United States enabled it to expand to an operational size which simply would not have been possible if these had not been forthcoming. This is plainly evident from the statistics on aircraft production in Chapter 4. Superb American carrier aircraft like the Avenger, Corsair and Hellcat enabled operations

to be undertaken over longer distances than was possible with British machines such as the Barracuda and Seafire. There is also little doubt that the aircrew were far happier flying these American aircraft in operations than many British built counterparts. Throughout the Second World War carriers proved to be very flexible tools contributing to the maintenance of an RAF presence on Malta and ferrying aircraft from the United States and around the world in addition to various operational roles. The reorganisation of carrier-based squadrons into larger Wings and Carrier Air Groups was an important development in improving operational coordination between squadrons for the larger operations which the FAA would undertake in 1944-1945. At a tactical level, naval squadrons operating ashore in the Western Desert and throughout the Mediterranean between 1940-1942 depended on a great deal of improvisation and help from the RAF to maintain their aircraft, but performed key operational roles with great effectiveness. The development of centralised, rather than squadron, maintenance led to much improved efficiency and helped to sustain more intensive flying training and operations.

The example of the British Pacific Fleet was used to conclude this study because it graphically illustrates the vital and complex nature of logistics in air warfare by the end of this period. Because the force was based in the Pacific and therefore required its own logistic arrangements it is easier to appreciate the sheer size of the logistic chain that was required. Indeed in many ways the logistic arrangements were more complex than the operations themselves. The Pacific operations also provided the author with an initial exposure to the importance of air logistics several years ago which led to this much more wide ranging analysis of air logistics during the two World Wars.

Appendix 1 – Planning for UK naval air stations, August 1942¹

Establishment	Function	Date commissioned
RNAS Arbroath (HMS Condor)	No.2 Observers' School Service Trials Unit TBR Deck Landing School Air Signal School	9 June 1940
RNAS Campbeltown (Books of Landrail)	Satellite to Machrihanish 1½ squadrons (living at Machrihanish)	1 April 1941 (under Merlin) 15 June 1941 (transferred to Landrail)
Reserve Aircraft Pool, Cowdray Park	Reserve aircraft storage	
RNAS Crail (HMS Jackdaw)	TBR School Fleet Requirements Unit 1 Disembarked squadron	1 October 1940
RNAS & Aircraft Repair Yard Donibristle (HMS Merlin)	Aircraft Repair Yard Communication squadron 2 Disembarked squadrons	24 May 1939
RNAS Dundee (Books of Condor)	Seaplane base	15 July 1941
RNAS East Haven (Books of Condor)	Satellite to Arbroath 1 Disembarked squadron	Under construction and development
RNAS Eastleigh (HMS Raven)	Observers Training Part I 2 Squadrons forming	1 July 1939
RNAS Elswick	4 Disembarked squadrons Torpedo facilities	Under construction
RN Air Section, RAF Evanton (Books of Merlin)	Reserve Aircraft Storage	
RNAS Fearn (HMS Owl)	4 Disembarked squadrons Torpedo facilities	1 August 1942

¹ Enclosure to Admiralty letter A.01214/42, 24 August 1942, ADM 1/13603.

RN Aircraft Repair Yard Fleetlands	Aircraft Repair Yard (Civil Establishment)	May 1940
RN Air Section, RAF Ford (Books of Condor)	RN Air Photographic School	
RN Training Centre, Fulham (Books of Daedalus)	Preliminary training of air fitters	
RNAS Haldon (Books of Heron)	Landing ground for use with range at Teignmouth	18 August 1941
RNAS Hatston (HMS Sparrowhawk)	5 Disembarked squadrons Torpedo facilities	2 October 1939
RNAS Henstridge (Books of Heron)	Satellite to Yeovilton 1 Disembarked squadron	Under construction and development
RNAS Lawrenny Ferry (Books of Daedalus)	Advanced Seaplane School	1 February 1942
RNAS Lee-on-Solent (Books of Daedalus)	Communication squadron 4 Disembarked squadrons	24 May 1939
RN Barracks, Lee-on-Solent (HMS Daedalus)	Headquarters of RANAS Depot for RN Air Ratings	24 May 1939
RNAS Machrihanish (HMS Landrail)	Fleet Requirements Unit TBR Pool Squadron 4½ Disembarked squadrons 1 RAF squadron Torpedo facilities	15 June 1941
RN Aircraft Training Establishment, Newcastle-under-Lyme (HMS Daedalus II)	Technical training of air fitters, apprentices and mechanics	May 1940
RNAS Ollerton (Books of Blackcap)	Advanced Instrument Flying School	13 August 1942
RNAS Portland (Books of Daedalus)	Seaplanes only	Reduced to care and maintenance basis
RNAS St Merryn (HMS Vulture)	Armament Training School 1 Disembarked squadron (Landing ground at Treligga	10 August 1940

	for aircraft using ranges)	
RN Camp, Risley (HMS Gosling)	Preliminary training of new entries (Radio Mechanics)	1 July 1942
RNAS Sandbanks (Books of Daedalus)	Preliminary Seaplane School	15 May 1940
RNAS Stornaway (Books of Mentor)	Seaplanes only	Reduced to care and maintenance basis
RNAS Stretton (HMS Blackcap)	2 Disembarked squadrons	1 June 1942
RN Air Section, RAF Sullom Voe (Books of Sparrowhawk)	Seaplanes only	Reduced to care and maintenance basis
RN Camp, Townhill, (HMS Waxwing)	Accommodation camp for air personnel awaiting draft	1 July 1942
RNAS Twatt (HMS Tern)	Fleet requirements unit (equivalent 2½ disembarked squadrons) 1 Disembarked squadron	1 April 1941 (in use) 1 January 1942 (commissioned)
RN Aircraft Training Establishment, Watford	Preliminary technical training	9 June 1942
RNAS Worthy Down (HMS Kestrel)	Air Gunners' School	24 May 1939
RNAS Yeovilton (HMS Heron)	Fighter School Fighter Direction School 1 Disembarked squadron Torpedo facilities (reduced to care and maintenance basis)	18 June 1940

Appendix 2 –

Dates of formations of new squadrons, 1939-1945¹

Pre-war squadrons

Fighters - 800, 801, 802, 803

Strike - 810, 811, 812, 813, 814, 818 (08/39) 820, 821, 822, 823, 824, 825

New fighter squadrons

1939 - 804 (30/11)

1940 - 806 (1/02), 805 (4/05 & 01/01/41), 808 (1/07), 807 (15/09)

1941 - 809 (15/01), 880 (15/01), 885 (1/03), 881 (1/06), 882 (15/07), 883 (10/10), 884 (1/11), 888 (1/11)

1942 - 886 (15/03), 887 (1/06), 889 (16/03), 890 (20/05), 893 (15/06), 891 (1/07), 892 (15/07), 894 (15/07), 897 (1/08), 896 (15/08), 898 (17/09), 879 (1/10), 895 (15/11)

1943 - 878 (1/03), 1830 (1/06), 1831 (1/07), 1833 (15/07), 1834 (15/07), 1832 (15/08), 1835 (15/08), 1836 (15/08), 1837 (1/09), 1770 (10/09), 1838 (1/10), 1839 (15/11), 1843 (15/12)

1944 - 1771 (1/02), 1847 (1/02), 1840 (1/03), 1841 (1/03), 1842 (1/04), 1843 (1/05), 1772 (1/05), 1845 (1/06), 1846 (1/07), 1848 (01/07), 1849 (01/08), 1850 (1/08), 1851 (01/09)

1945 - 1790 (1/01), 1852 (01/02), 1791 (15/03), 1853 (01/04), 1792 (15/05)

New strike squadrons

1939 - 816 (3/10), 815 (9/10)

1940 - 819 (15/01), 826 (15/03), 829 (15/06), 827 (15/09), 828 (15/09), 830 (1/07)

1941 - 817 (15/03), 831 (1/04), 832 (01/04), 833 (8/12), 834 (10/12)

1942 - 835 (15/02), 836 (1/03), 837 (1/05), 838 (15/04), 840 (01/06), 841 (01/07)

1943 - 845 (01/02), 842 (01/03), 846 (01/04), 847 (01/06), 848 (01/06), 849 (01/08), 850 (01/09), 851 (01/10), 852 (01/11), 853 (01/12)

1944 - 854 (01/01), 855 (01/02), 856 (01/03), 857 (01/04)

¹ Information from Ray Sturtivant and Theo Balance, *The Squadrons of the Fleet Air Arm* (Tonbridge: Air Britain, 1994).

Appendix 3 – Availability of Escort Carriers, 1943-1944¹

Date	Completing Alterations (U.K. or Vancouver)	In service UK	No in service	Special Allocation
August 1943		Argus Activity Archer Biter Battler Attacker Hunter Stalker Ravager Pretoria Castle	10	DLT (Non- operational) DLT or Trade only Trade only “ “ Not fully modified Fighter Fighter Fighter Not fully modified DLT Trials Carrier
September	Searcher, Chaser, Striker	Fencer Tracker	12	
October	Nairana, Vindex, Pursuer, Ameer (V)	Searcher Chaser	14	Fighter Ferry
November	Emperor (UK), Begum (V), Atheling (V), Empress (V)	Striker	15	Trade
December	Trumpeter (UK), Slinger (UK), Khedive (UK), Campania (UK), Speaker (V), Nabob (V), Shah (V)	Pursuer Emperor Nairana Vindex	19	
January 1944	Premier (V), Patroller (V)			
February	Ranee (V)	Ameer Trumpeter Slinger		Proposed Fighter

¹ Minute by Director of Plans, 15 Aug 1943, ADM 1/12639.

		Khedive Begum Empress Atheling Campania	27	Proposed Fighter
March	Thane (V), Rajah (V), Queen (V)	Nabob	28	
April	Trouncer (V), Ruler (V)	Speaker Shah Premier Patroller	32	Proposed Fighter Proposed Fighter
May	Arbiter (V)	Ranee	33	
June	Puncher (V) Reaper (V)	Rajah Thane	35	
July		Queen Trouncer Ruler	38	Proposed Fighter
August	Smiter (V)	Arbiter	39	
September		Puncher	40	Proposed Fighter
October		Reaper	41	
November		Smiter	42	

Appendix 4 –
Efficiency of maintenance at naval air stations, 1945¹

Station	Type of Maintenance	Ratings per 1000 flying hours
Yeovilton	Centralised	335
Hinstock	“	372
Henstridge	“	383
Ronaldsway	“	445
Inskip	“	524
		Average: <u>412</u>
Crail	Squadron Centralised	498
Ratray	“ “	596
		Average: <u>547</u>
Drem	Squadron	367
Eglinton	“	421
Fearn	“	467
Dale	“	482
Grimsetter	“	483
St Merryn	“	488
Burscough	“	504
Twatt	“	546
Machrihanish	“	563
Ayr	“	585
Easthaven	“	637
		Average: <u>504</u>

¹ Report No.12 from Operational Research Section attached to Admiral (Air), December 1945, ADM 116/5699.

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P464	H.P. Currey	91/29/1	J.A. Stewart-Moore
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12346	W.C. Argent	9462	C. Hillman
8323	A.G. Beeton	020	H.T. Holdstock
002	C.N.H. Bilney	10409	G.F. Hyams
004	F.D.H. Bremner	026	L.H. Kemp
13718	C.P. Bristow	037	H. de Verd Leigh
006	C.C. Burne	028	C.A. Mann
9460	L. Coombes	12099	H.A. Marsh
12255	A. Cross	038	J.S. Middleton
3168	W. Dickson	317	F.D. Silwood
018	G. Donald	298	H.R. Stubbington
3167	A. Ellwood	301	R. Sykes
998	T. Elmhirst	308	H. Thompson
015	E.J. Furlong	309	T.B. Thompson
303	V. Goddard	311	F.W. Verry
3189	V. Goddard	29	W.E.D. Wardrop
8950	E.W. Hancock	313	T.B. Williams

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4662	W. Anderson	18663	E. Kerridge
11473	R. Baillie	9735	M.C. Kingsmill
12038	G.C. Baldwin	16254	P.M. Lamb
20667	D. Baring-Gould	18701	R.H. Law
9868	R.H. Barrett	15160	K. Lawn
14212	B. Bevans	21197	R. Lewin
12175	R.L. Bigg-Wither	11088	S.A. Mearns
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12279	E.M. Brown	6818	J.L. Moulton
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12334	V.H. Day	10687	J.F. Quill
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Robert Hayter	Mr Ward
John Holland	Peter Warde
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